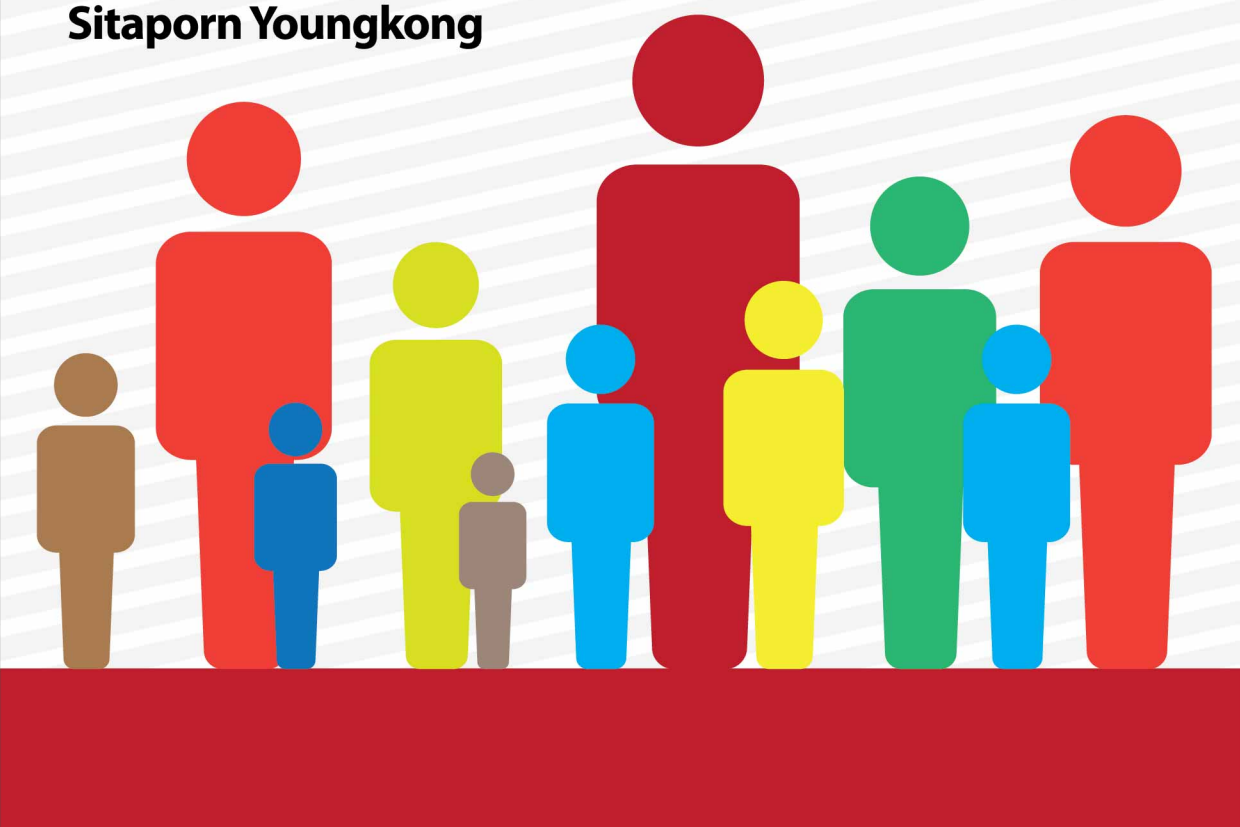
MULTI-CRITERIA DECISION ANALYSIS FOR PRIORITY SETTING OF HEALTH INTERVENTIONS IN THAILAND

Sitaporn Youngkong



Multi-criteria decision analysis for priority setting of health interventions in Thailand

Proefschrift

ter verkrijging van de graad van doctor aan de Radboud Universiteit Nijmegen
op gezag van de rector magnificus prof.mr.S.C.J.J. Kortmann,
volgens besluit van het college van decanen in het openbaar te verdedigen op

donderdag 14 juni 2012
om 10.30 uur precies

door
Sitaporn Youngkong
geboren op 13 juli 1976
te Samutprakan, Thailand

Promotor: Prof.dr.Koos van der Velden
Copromotoren: Dr. Rob Baltussen
Dr.Yot Teerawattananon (Health Intervention and Technology Assessment Program (HITAP), Thailand)

Manuscriptcommissie:
Prof.dr.Gert Jan van der Wilt
Prof.dr.Andre van der Ven
Prof.dr.Ole Frithjof Norheim (University of Bergen, Norway)

Multi-criteria decision analysis for priority setting of health interventions in Thailand

Doctoral thesis

to obtain the degree of doctor from Radboud University Nijmegen
On the authority of the Rector Magnificus prof.dr.S.C.J.J. Kortmann,
according to the decision of the Council of Deans to be defended in public on

Thursday, 14 June 2012
At 10.30 hours

by
Sitaporn Youngkong
Born in Samutprakan, Thailand
On 13 July 1976

Supervisor:	Prof. dr. Koos van der Velden
Co-supervisors:	Dr. Rob Baltussen Dr.Yot Teerawattananon (Health Intervention and Technology Assessment Program (HITAP), Thailand)
Doctoral Thesis Committee:	Prof.dr. Gert Jan van der Wilt Prof.dr. Andre van der Ven Prof.dr. Ole Frithjof Norheim (University of Bergen, Norway)

Contents

CHAPTER 1
Introduction

Introduction

High-cost health interventions including pharmaceuticals and medical technologies are becoming more and more available in Thailand, thereby increasing public and patient expectations. However, due to limited resources, the government cannot make all of those interventions available to the population. This indicates the need to search for ways of using existing budgets more efficiently, including setting priorities on which interventions should be publicly funded.

Yet, priority setting of health interventions is one of the most challenging and difficult issues faced by health policy decision-makers around the world. It is especially relevant and important in low- and middle-income countries (LMIC), where health needs are large and resources are very limited. The priority setting process is said to be further complicated by several factors, including political instability, weak institutions, the involvement of multiple players in the process with sometimes conflicting objectives, a lack of evidence on the performance of interventions – all issues that hamper systematic priority setting [1, 2]. As a result, priority setting decisions in LMIC including Thailand is often history-based and ad-hoc, and relies often on policy makers' opinions, the preferences of international funding agencies, lobbying and political pressure [3].

Towards rational priority setting in health care

Recent decades have witnessed the development of various explicit criteria to rationalise the priority setting process. Most importantly, and a cornerstone of many national disease programmes, is the capacity of interventions to maximize general population health, i.e. its effectiveness [4, 5]. Others have proposed cost and cost-effectiveness as important criteria to guide choices in health care – these criteria explicitly recognise the economic constrains of the provision of health care, and imply that only those interventions that show value for money should be publicly

financed [6-9]. However, the sole use of criteria 'effectiveness' or 'efficiency' falls short to capture other important aspects of health care that guide the choice of interventions. Ethical concerns (e.g. preferences of society to giving priority to interventions that target vulnerable populations like the severely ill, the poor, or the very young) or practical considerations (like availability of trained health workers [10]) may be equally important, or should at least be considered (Figure 1).

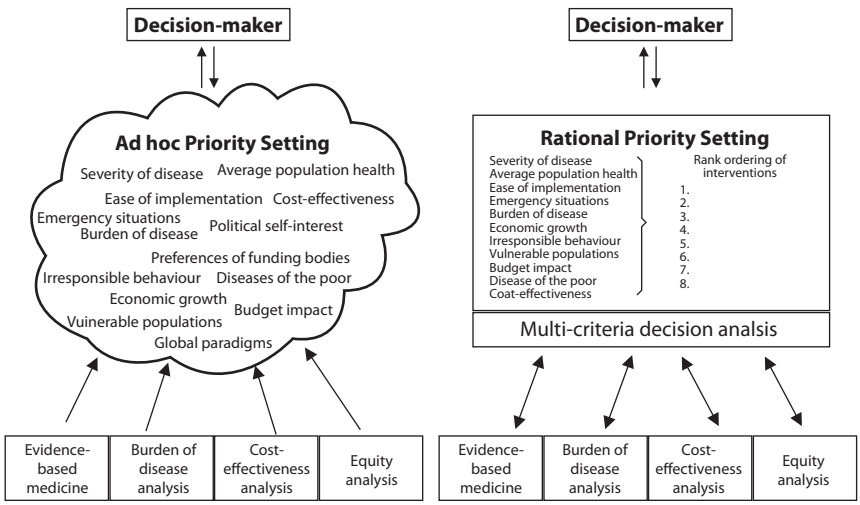


Figure 1 Ad hoc priority setting and rational priority setting

Source: Baltussen R, Niessen L (2006) Priority setting of health interventions: the need for multi-criteria decision analysis. Cost Effectiveness and Resource Allocation 4: 14.

Priority setting on the basis of only one or two criteria are criticised as oversimplified technical solutions' and to inadequately reflect the complex process of priority setting [11-14]. They are therefore unlikely to be acceptable for most policy makers in many countries [3, 5, 15-17] including in Thailand [14, 18].

Several scholars have recognised this and proposed alternative decision criteria that take into account other concerns, including severity of disease (e.g. the 'proportional shortfall' method by Stolk et al [19]) or age ('fair innings' argument by Willams [20]). Musgrove [21] proposed a sequence on the use of economic efficiency criteria (public goods, externalities, catastrophic cost, and cost-effectiveness), ethical (poverty, horizontal and vertical equity, and the rule of rescue), and political criteria, in selecting which health intervention should be spent by public funds. The use of multiple criteria also trickled through in a few national processes on priority setting. For instance, effectiveness, efficiency, equity and acceptability were used as criteria to prioritise health services in New Zealand [22]. The Dutch Government Committee on Choices in Health Care, the so-called Dunning Committee, employed four explicit priority criteria, i.e. necessity, effectiveness, efficiency and individual responsibility, to determine a basic service package [22, 23]. The latter was only partially successful, one of the reasons being that the criteria were not well-defined.

Overall, the above suggest the need for rational approaches in priority setting, taking into account a comprehensive set of relevant criteria simultaneously. While this holds relevance in all countries around the world, the scope to develop rational priority setting is particularly large in Thailand – its government has recently developed institutional arrangements to promote evidence-based medicine and rational priority setting through the Health Intervention and Technology Assessment Program (HITAP). HITAP was established in 2007 as a non-profit organization, coming under the auspices of the Ministry of Public Health. Its main responsibility is to assess health intervention as well as social health policy. HITAP places emphasis on systematic, transparent work, which is in conformity with the current situation of Thailand's health system – it thereby aims to cultivate the public interest and motivate the participation of all sectors in society in order to efficiently distribute and allocate the limited resources to fulfill the public

objectives [24]. The establishment of HITAP was only the direct lead to the conduct of the present thesis, and the research questions as described below.

Research questions

Against the abovementioned background, the main research question of this thesis is "what is an optimal strategy to prioritise health interventions in Thailand?"

There are three sub-questions:

1. What is the current situation of priority setting of health interventions in LMIC?
2. What is the implementation process of multi-criteria decision analysis (MCDA) in Thailand?, more specifically, a) how to define priority setting criteria?, b) how to rank order health interventions?, and c) what are the challenges in the implementation process of MCDA?
3. How is MCDA best used for priority setting in Thailand?

Outline of the thesis

This introductory chapter continues with an outline on how the different chapters address the stated research sub-questions and describes their contents (Figure 2).

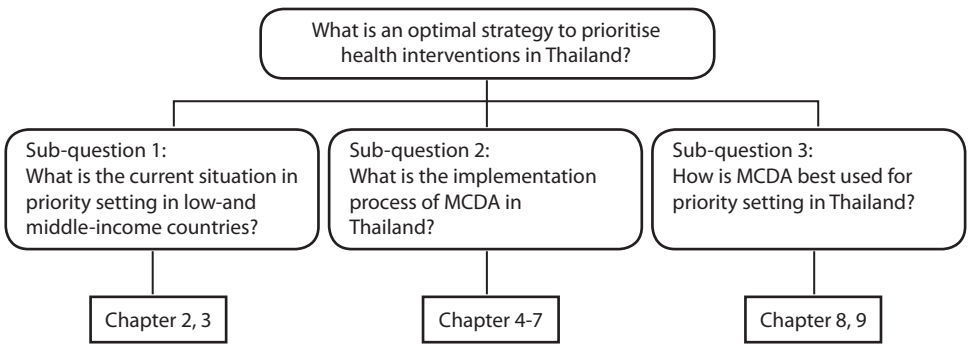


Figure 2 Overview of outline of the thesis by research questions

Chapter 2 replies to the research sub-question 1, and provides an overview of all empirical studies on priority setting using multiple criteria in LMIC. We systematically reviewed empirical priority setting studies in LMIC that were published from January 1997 to October 2008 in English. Eighteen studies were identified and classified according to their characteristics (i.e. country(-ies) where the studies were conducted, area of prioritisation, decision-making level(s), and study objectives), and methodological approaches (i.e. which type of respondents (or stakeholders) was involved, how criteria were identified, which criteria were identified, how preferences for the criteria were elicited, and how results were presented).

Chapter 3 also replies to the research sub-question 1. This chapter presents a study that reports on a single criterion for priority setting only, i.e. the economic impact of a disease, and thereby provides insufficient information for adequate priority setting. On the basis of these two chapters, I developed the conceptual framework to use in the following chapters.

Chapter 4 – 6 report on the use of multi-criteria decision analysis (MCDA) to set priorities in HIV/AIDS control and the universal coverage health benefit package. These chapters responds to the research sub-question 2.

The chapters all use the same framework of MCDA. MCDA is defined as 'a set of methods and approaches to aid decision-making, where decisions are based on more than one criterion, which make explicit the impact of decision of all the criteria applied and the relative importance attached to them' [25]. MCDA is illustrated in Figure 1. We choose MCDA because it encompasses a broad range of different approaches, and allows decision-makers to identify and consider a set of criteria simultaneously – it thereby responds to the above mentioned limitations of present approaches to priority setting. MCDA involves the establishment of a panel of relevant stakeholders, the identification of a comprehensive set of criteria by the panel, and the assessment of the performance of interventions on those criteria in a so-called performance matrix (Table 1). The panel then inspects the performance matrix qualitatively or quantitatively to rank order interventions. In a qualitative inspection, the panel simply interprets the performance matrix, and make implicit judgments on the weights of the various criteria. In a quantitative inspection, the panel weigh the different criteria on the basis of its relative importance, and multiply the scores by the weights to obtain weighed averages for all interventions. Interventions can subsequently be rank ordered according to these weighed averages.

Table 1 Performance matrix

Options	Cost-effectiveness	Severity of disease	Disease of the poor	Age
Antiretroviral treatment in HIV / AIDS	US$200 per DALY	●●●●	√	15 years and older
Treatment of childhood pneumonia	US$20 per DALY	●●●●	√	0 - 14 years
Inpatient care for acute schizophrenia	US$2000 per DALY	●●		15 years and older
Plastering for simple fractures	US$50 per DALY	●		all

A tick indicates the presence of a feature. Severity of disease is shown of a four-scale, with more stars indicating a more severe disease.

Source: Baltussen R, Niessen L (2006) Priority setting of health interventions: the need for multi-criteria decision analysis. Cost Effectiveness and Resource Allocation 4: 14.

In the chapters, we employed Discrete Choice Experiments (DCE), to determine the relative importance of criteria for priority setting in this thesis. In a DCE, respondents choose their preferred option from sets of hypothetical scenarios, each consisting of a bundle of criteria that describe the scenario in question. The criteria are constant in each scenario, but the levels that describe each criterion may vary across scenarios. Analysis of the options chosen by respondents in each scenario reveals the extent to which each criterion is important to the decision at hand [26, 27]. Running a DCE involves selection of participants, identification of criteria through group discussion, DCE design and administration of the DCE survey.

Case study 1: priority setting of HIV/AIDS interventions in Thailand

HIV/AIDS is recognized as a leading cause of death and a high burden of disease in Thailand [28]. A wide range of preventive, treatment and care programmes have been implemented since long to combat the disease. Although a sizeable budget for implementation of this plan is available - derived from both the Thai government and

the International Monetary Fund [29] - there will never be enough resources to implement every programme for all target groups at full scale. Consequently, Thai policy makers now face the challenge on how scarce resources on HIV/AIDS control can be spent more wisely.

A range of studies are available to guide Thai policy makers to prioritise HIV/AIDS interventions. International estimates are available on the effectiveness and cost-effectiveness of HIV/AIDS interventions [30-32], and a recent document has systematically reviewed this information - in combination with national estimates - to inform priorities in HIV/AIDS control [33]. Yet, the analysis falls short to include other criteria that may play important roles in decision-making such as ethical and social concerns. However, as of yet, there is no evidence on the criteria that should guide the priority setting of HIV/AIDS programmes in Thailand, including their relative importance.

Chapter 4 reports on the DCE we carried out to identify the criteria and to assess their relative importance for priority setting of HIV/AIDS interventions in Thailand. The results of this chapter were used to prioritise HIV/AIDS interventions in Chapter 5. The chapter illustrates the feasibility of MCDA to prioritise HIV/AIDS interventions in Thailand, and also shows the usefulness of elaborative process as an integrated component of MCDA.

Case study 2: priority setting for health benefit package development in Thailand

Chapter 6 describes the first experience in using MCDA as an overall methodological approach for rational and transparent priority setting to support the coverage decisions on including health interventions in the universal health coverage benefit package in Thailand, in the period 2009-2010.

The Universal Coverage (UC) scheme is a tax-funded health insurance

scheme that offers a comprehensive health benefit package including preventive, curative, and rehabilitative health services to eligible beneficiaries (approximately 47 millions of Thai population). In the past, decisions on the public reimbursement of interventions were typically ad-hoc and not transparent: e.g. certain interest groups (like politicians, health professionals or industry) could selectively advocate new interventions for public reimbursement. Although the UC has referred its medicine list from a National List of Essential Drugs (NLED) which has been created on the basis of explicit selection criteria – known as ISafE score [34] – the NLED focuses only on medicines, while the benefit package determines a broader range of health interventions than medicines. Decision makers in Thailand have recently acknowledged this inadequate process and called for more rational, transparent and fair decisions on the public reimbursement of interventions to improve population health in the country.

In **chapter 7**, we evaluate a tool for priority setting - Evidence and Value: Impact on Decision-Making (EVIDEM) – in its ability to set priorities across a range of competing interventions. While EVIDEM also employs MCDA as its conceptual framework, it falls short in a number of aspect. We propose a stepwise process to identify criteria, weights, and rank ordered interventions. The reasoning is illustrated with information on the relative importance of criteria as identified in the priority setting study on the UC health benefit package.

Chapter 8 capitalises a first set of experiences on the application of MCDA in seven LMIC, including Thailand. It shows a variety of criteria are used in decision making and addresses the extent to which MCDA can guide priority setting in health care. Finally, **chapter 9** discusses the main findings and responds to the research questions as defined in the present chapter. This includes a number of recommendations to improve the priority setting process in Thailand and, more generally, research on priority setting. These two chapters address the research sub-question 3.

Reference

1. Kapiriri, L. and D.K. Martin, *A strategy to improve priority setting in developing countries.* Health Care Analysis, 2007. **15**: p. 159-167.
2. Bryant, J.H., *Health priority dilemmas in developing countries*, in *The global challenge of health care rationing*, A. Coulter and C. Ham, Editors. 2000, Open University Press: Philadelphia. p. 63-73.
3. Chalkidou, K., R. Levine, and A. Dillon, *Helping poorer countries make locally informed health decisions*. BMJ, 2010. **341**: p. 284-286.
4. Mitton, C.R., *Priority setting for decision makers: Using health economics in practice*. European Journal of Health Economics, 2002. **3**: p. 240-243.
5. Musgrove, P. and J. Fox-Rushby, *Cost-effectiveness analysis for priority setting, in Disease Control Priorities in Developing Countries*, D. Jamison, et al., Editors. 2006, Oxford University Press: New York.
6. Evans, D., et al., *Achieving the millennium development goals for health: Time to reassess strategies for improving health in developing countries.* BMJ, 2005. **331**: p. 1133.
7. Jamison, D., et al., *Disease Control Priorities in Developing Countries.* 2nd ed2006, New York: Oxford University Press.
8. Mill, J., *Utilitarianism* 2001, London: Hackett Publishing Company Inc.
9. Teerawattananon, Y., *Assessing the feasibility of using economic evaluation in reimbursement of health care services in Thailand,* 2006, University of East Anglia: Norwich.
10. Mauskopf, J., et al., *Principles of good practice for budget impact analysis: report of the ISPOR task force on good research practices - budget impact analysis.* Value in Health, 2007. **10**(5): p. 336-347.
11. Holm, S., *Goodbye to the simple solutions: the second phase of priority setting in health care*. BMJ, 1998. **317**: p. 1000-1003.
12. Hoedemaekers, R. and W. Dekkers, *Justice and solidarity in priority setting in health care.* Health Care Analysis, 2003. **11**(4): p. 325-343.
13. Evans, D.B., et al., *Methods to assess the costs and health effects of interventions for improving health in developing countries.* BMJ, 2005. **331**(7525): p. 1137-1140.
14. Teerawattananon, Y. and S. Russell, *The greatest happiness of the*

greatest number? Policy actors' perspectives on the limits of economic evaluation as a tool for informing health care coverage decisions in Thailand. BMC Health Services Research, 2008. **8**: p. 197.
15. Creese, A., et al., *Cost-effectiveness of HIV/AIDS interventions in Africa: a systematic review of the evidence*. The Lancet, 2002. **359**: p. 1635-42.
16. Brock, D. and D. Wikler, *Ethical issues in resource allocation, research, and new products development, in Disease control priorities in developing countries*, D.T. Jamison, et al., Editors. 2006, Oxford University Press and the World Bank: New York.
17. Masaki, E., et al., *Cost-effectiveness of HIV interventions for resource scarce countries: Setting priorities for HIV/AIDS,* 2003, Bay Area International Group: University of California, Berkeley.
18. Yothasamut, J., S. Tantivess, and Y. Teerawattananon, *Using economic evaluation in policy decision-making in Asian countries: Mission impossible or mission probable?* Value in Health, 2009. **12**(3): p. S26-S30.
19. Stolk, E., et al., *Reconciliation of economic concerns and health policy: illustration of an equity adjustment procedure using proportional shortfall.* Pharmacoeconomics, 2004. **22**(17): p. 1097-1107.
20. Williams, A., *The 'fair innings argument' deserves a fairer hearing! comments by Alan Williams on Nord and Johannesson.* Health Economics, 2001. **10**: p. 583-585.
21. Musgrove, P., *Public spending on health care: how are different criteria related?* Health Policy, 1999. **47**: p. 207-223.
22. Sabik, L.M. and R.K. Lie, P*rioritiy setting in health care: Lessons from the experiences of eight countries*. International Journal for Equity in Health, 2008. **7**: p. 4.
23. Stolk, E. and M. Poley, *Criteria for determining a basic health services package: Recent developments in the Netherlands*. European Journal of Health Economics, 2005. **50**: p. 2-7.
24. Health Intervention and Technology Assessment Program. 2011 14 October 2011];
Available from: http://www.hitap.net/index_en.php.
25. Devlin, N. and J. Sussex, *Incorporating multiple criteria in HTA:*

Methods and processes, 2011, Office of Health Economics: London.
26. Ryan, M. and K. Gerard, *Using discrete choice experiments to value health care programmes: current practice and future research reflection*. Applied Health Economics and Health Policy, 2003. **2**(1): p. 55-64.
27. Kjær, T., *A review of the discrete choice experiment – with emphasis on its application in health care*, 2005, University of Southern Denmark: Odense. p. 143.
28. UNAIDS/WHO working on global HIV/AIDS and STI, *Epide-miological fact sheet on HIV and AIDS: Core data on epidemi-ology and response,* 2008, World Health Organization: Geneva.
29. The National Committee for HIV and AIDS Prevention and Alleviation, *The National Plan for Strategic and Integrated HIV and AIDS Prevention and Alleviation 2007 - 2011: Key contents*, 2007, The Agricultural Co-operative Federation of Thailand.
30. Masaki, E., et al., *Cost-effectiveness of HIV interventions for resource scarce countries: setting priorities for HIV/AIDS*, 2003, University of California: Berkeley. p. 30.
31. Kumaranayake, L. and C. Watts, *Resource allocation and priority setting of HIV/AIDS interventions: Addressing the generalized epidemic in Sub-Saharan Africa*. Journal of International Development, 2001. **13**: p. 451-466.
32. Ainsworth, M., *Setting government priorities in preventing HIV/AIDS*. Finance and Development 1998(March): p. 18-21.
33. Pattanaphesaj, J. and Y. Teerawattananon, *Reviewing the evidence on effectiveness and cost-effectiveness of HIV prevention strategies in Thailand*. BMC Public Health, 2010. **10**: p. 401.
34. Chongtrakul, P., N. Sumpradit, and W. Yoongthong, *ISafE and the evidence-based approach for essential medicines selection in Thailand*. Essential Drugs Monitor, 2005(34): p. 18-19.

CHAPTER 2

Setting priorities for health interventions in developing countries: a review of empirical studies

Sitaporn Youngkong
Lydia Kapiriri
Rob Baltussen

Tropical Medicine and International Health 2009; 14(8): 930-393

Abstract

Objective: To assess and summarize empirical studies on priority setting in developing countries.

Methods: Literature review of empirical studies on priority setting of health interventions in developing countries in Medline and EMBASE (Ovid) databases.

Results: Eighteen studies were identified and classified according to their characteristics and methodological approaches. All studies were published after 1999, mostly between 2006 and 2008. Study objectives and methodologies varied considerably. Most studies identified sets of relevant criteria for priority setting (17/18) and involved different stakeholders as respondents (11/18). Studies used qualitative (8/15) or quantitative (3/15) techniques, or combinations of these (4/15) to elicit preferences from respondents. In a few studies, respondents deliberated on results (3/18). A minority of studies (7/18) resulted in a rank ordering of interventions.

Conclusions: This review has revealed an increase in the number of empirical studies on priority setting in developing countries in the past decade. Methods for explicit priority setting are developing, being reported and are verifiable and replicable and can potentially lead to solutions for ad hoc policy making in health care in many developing countries.

Keywords

priority setting, developing countries

Introduction

Priority setting of health interventions is one of the most challenging and difficult issues faced by health policy decision-makers around the world. It is a process that is inevitably value-laden and political (1-5), requiring credible evidence, strong and legitimate institutions and fair processes (6-9).

Priority setting is especially important in developing countries, where resources are limited and government expenditures on health are less than US$20 per capita per year (10). As Kapiriri and Martin (11) argue, this is further complicated by: (i) the burden of under development in these countries which increases the gap between the health needs and resources available to respond to them; (ii) the many uncertainties in priority setting because of lack of dependable information; (iii) the multiple players with various agendas; (iv) few systematic processes for decision-making; and (v) many obstacles to implementation such as political instability, inadequately developed social sectors, weak institutions and marked social inequalities, which make the implementation of systematic priority setting processes difficult (4). As a result, priority setting in developing countries is often ad-hoc or history-based (11, 12).

There have been a number of international efforts to promote rational priority setting by addressing the information gaps, such as studies on burden of disease (BoD) (13) and cost-effectiveness analysis (CEA) (14, 15). Many such studies have also been carried out at the national level, e.g. in Mexico, India, and a set of east and northern African countries (16). Although these initiatives may have improved the evidence-based for priority setting, it was also observed that the resulting information is only input to complex process of priority setting and that 'simple technical solutions' are insufficient (15, 17-21).

In response to this, a growing number of empirical studies have

explored more comprehensive approaches to priority setting in developing countries in the past decade. For example, researchers have tested different strategies to involve all relevant stakeholders in the priority setting process (22), or to identify the relative importance of CEA and severity of disease as criteria for priority setting (23). While these studies provide valuable information with potential benefit to policy-makers and researchers, a review is lacking and the options and limitations of the various approaches are difficult to assess.

We reviewed empirical studies on priority setting of health interventions in developing countries, classified their methodological approaches and defined methodological suggestions for future studies. Thus we aimed at stimulating discussion on the options and limitations of the various approaches. This paper defines priority setting as the process of rank ordering interventions with the aim of informing decision-makers on the implementation of these interventions.

Methods

We carried out a literature search in November 2008 using the Medline and EMBASE (Ovid) databases. In a first step, we performed a search using the following keywords: 'health' and 'priority-setting' or 'prioritization' or 'resource allocation', in combination with the names of developing countries according to World Bank 2008 definitions (24). We limited the search to studies published in English available from January 1997 to October 2008. Next we (i) included studies in the review if they reported empirical data to guide future priority setting of interventions in health care and (ii) excluded studies from the review if they reported on a single criterion for priority setting only (this excludes CEA or BoD studies). In this step, we initially screened study abstracts on these criteria and subsequently obtained full-text formats for studies that seemed relevant. The final inclusion of studies in the

review was based upon a detailed assessment of the full-text formats (studies for which no full-text format was available were excluded). All abstracts and full-text formats were reviewed independently by both authors. In case we disagreed, a discussion was arranged to reach a consensus. As step 3, a snowballing technique was used to identify related articles in this context and these were also assessed using the same inclusion and exclusion criteria.

We then classified identified studies according to four general characteristics: i) country(ies) where the studies were conducted; ii) area of prioritization; iii) decision-making level(s); and iv) study objectives. In addition, we classified identified studies according to their methodological approaches to the priority setting process. Here, we distinguished: i) which type of respondents (or stakeholders) was involved; ii) how criteria were identified; iii) which criteria were identified; iv) how preferences for the criteria were elicited; and v) how results were presented.

Results

The first step in the literature search resulted in a total of 1,291 studies. In the second step, these studies were initially screened on their abstract and 1,235 studies were excluded. The remaining 56 studies were assessed on the basis of the full-text formats and of these, 39 articles were excluded. Studies were excluded because, e.g. they merely assessed the participation of stakeholders in the priority setting process in the past (e.g. Mubyazi et al. 2007 (25)); assessed the relevance of a single criterion in priority setting (e.g. Kapiriri et al. 2003 (26)); or assessed the priorities in targeting of diseases (thus not interventions) (e.g. Makundi et al. 2005 (27); Rosato et al. 2006 (28)). A total of 18 studies were finally selected (Table 1).

All studies were published after 1999; and 13 in the period 2006–2008. Four studies were conducted in Uganda, three in Tanzania, two each in South Africa and Ghana and one each in Bosnia-Herzegovina, Ghana, Pakistan, Nepal, Argentina, Chile and Thailand. One study researched priority setting in three developing countries (Burkina Faso, Ghana and Indonesia). The studies covered a wide range of priority setting areas: 10 studies prioritised interventions across the healthcare system, four studies across several disease areas and four studies concentrated on particular disease areas. Most of the identified studies (14/18) focused on priority setting at the national level. One study in Tanzania evaluated the priority setting process at the district and community levels and three considered priority setting process at the institutional level, i.e. a hospital. In terms of study objectives, 13 studies primarily aimed at identifying criteria for setting priorities in health care. Three studies explored the acceptability of using economic evaluation or burden of disease information in decision-making health priorities. One study examined the introduction of 'Accountability for reasonableness' to improve the priority setting process and one study described the priority setting process as experienced by stakeholders.

Table 1 General characteristics of the 18 included empirical priority setting studies in developing countries

	Characteristics			
Study	Country	Area of prioritisation	Decision- making level	Objectives
Teerawattananon and Russell (2008)	Thailand	Several disease area (two hypothetical case scenarios)	National	To explore policy actors' justifications for their decisions on the 2 case scenarios
Vargas and Poblete (2008)	Chile	Health system	National	To examine the introduction of a prioritised list of 56 health conditions in Chile by using multiple criteria
Lasry et al. (2008)	South Africa	HIV/AIDS	Organization (primary health care clinic)	To apply the system for HIV/AIDS resource allocation to a primary healthcare clinic
Ottersen et al. (2008)	Tanzania	Health system	National	To explore distributions preferences among health planners
Mshana et al. (2007)	Tanzania	Health system	District	To describe an initiative in Tanzania to improve priority setting using 'Accountability for reasonableness' (A4R)
Makundi et al. (2007)	Tanzania	Several disease area	National	To test out a model for priority-setting which incorporate both scientific evidence and public values
Rubinstein et al. (2007)	Argentina	Health system	National	To determine whether economic evaluations are considered and used by decision-makers and report the criteria decision-makers used for resource allocation
Baltussen et al. (2007)	Nepal	Several disease area	National	To identify the various criteria for priority setting, and rank ordering health interventions
Husain et al. (2007)	Pakistan	HIV/AIDS	National	To identify perceptions of decision-makers about the process of resource allocation within the National AIDS Control Programme
Madi et al. (2007)	Burkina Faso Ghana Indonesia	Safe motherhood programme	National	To describe a process to elicit and prioritised evaluation needs for safe motherhood programme
Kapiriri et al. (2007)	Uganda (Canada and Norway)	Health system	Organization (publicly funded hospital)	To describe the process of healthcare priority setting and evaluate the description using the framework of A4R
Kapiriri and Martin (2006)	Uganda	Health system	Organization (1,500 bed-public hospital)	To describe priority setting process in a hospital and evaluate the description using A4R

Table 1 (Continued)

Study	Characteristics			
	Country	Area of prioritisation	Decision- making level	Objectives
Baltussen et al. (2006)	Ghana	Several disease area	National	To identify the various criteria for priority setting, and rank ordering health interventions
Kapiriri and Norheim (2004)	Uganda	Health system	National	To explore the acceptance of priority setting criteria for healthcare system
Kapiriri et al. (2004)	Uganda	Health system	National	To establish the relative preferences regarding cost-effectiveness of interventions and severity of disease as main criteria for setting priorities
Reichenbach (2002)	Ghana	Reproductive health (breast and cervical cancer)	National	To examine the influence of political and organizational factors on national priority setting
Hrabač et al. (2000)	Bosnia and Herzegovina	Health system	National	To provide an overview of the methodology for designing a basic package of health entitlements
Söderlund (1999)	South Africa	Health system	National	To define package of essential hospital care

Table 2 describes the methodological approaches of the reviewed studies. In terms of respondents, 11 studies included more than one type of stakeholder (with policy makers being most often included). Among these, Makundi et al. (22) involved four types of respondents – policy makers, health workers, general population and people living with HIV/AIDS. Kapiriri et al. (23) included the largest number of respondents (413 respondents in Uganda). In terms of approaches to identify criteria, 10 studies organized group discussions or held interviews. Eight studies identified criteria from a literature review. In terms of identified criteria, cost-effectiveness was the most common important criterion considered (in 12 of the 17 studies that identified criteria), followed by severity of disease (6/17). Other criteria included burden of disease, age of target group, poverty reduction, effectiveness/benefit of treatment and health effects.

In terms of eliciting preferences for those criteria, a wide range of approaches were used. Eight studies relied solely on (combinations of) qualitative

approaches to elicit participants' preferences, i.e. by semi-structured interviews, group discussions and key informant interviews. Another three studies relied solely on quantitative approaches to elicit participants' preferences, i.e. by discrete-choice experiments (DCE) and questionnaires involving a rating scale. Four studies combined qualitative and quantitative techniques, i.e. Makundi et al. (22) employed individual rating and group discussions with a balance sheet to test a model of combining evidence and public values in priority-setting and Ottersen et al. (29), Madi et al. (30) and Kapiriri et al. (23) used group discussions and questionnaires with rating questions to explore respondents' preferences regarding cost-effectiveness and severity of disease. It is to be noted that three studies applied an explicit deliberative process to address both quantitative and non-quantitative concerns (such as ethical considerations) (22, 29, 30) and they did so to reach a consensus by the stakeholders involved.

In terms of presentation of results, seven studies rank-ordered health interventions, three studies rank-ordered identified criteria, five studies listed the criteria for setting priorities and three studies described participants' views.

Discussion

This review has revealed an increase in the number of empirical studies on priority setting in developing countries in the past decade. Methods for explicit priority setting are developing, being reported and are verifiable and replicable. In combination with increasingly available evidence of all sorts on diseases and related interventions, these methods can potentially be solutions for the ad hoc policy making in health care in many developing countries. Yet, most of the studies included in our review are small pilot studies and do not include an evaluation of the impact of its finding on actual priority setting. Only when such information becomes available, clear recommendations to scale up

certain methods can be given.

Nevertheless, the review allows us to provide a number of suggestions on the various aspects of the methodological approaches, on the basis of a comparison of our findings to observations on good priority setting practice in the literature. First, most of the studies in this review involved policy makers, health workers and general population in their priority setting process. This concurs with observations in the literature (31-34) that stress the need to involve the views of other stakeholders in addition to those of policy makers, especially that of the public, in debates on rationing to enhance the legitimacy and fairness of decision-making. We therefore suggest future studies to involve relevant stakeholders.

Secondly, a number of studies involved only a limited number of quantitative criteria, whereas observations in the literature (12, 35) stress that many other criteria, including medical (e.g. effectiveness of interventions and severity of disease) and non-medical (e.g. economic efficiency, ethical reasons and political circumstances) criteria, may also be important and relevant. In addition, some studies identified criteria through literature review, whereas the definitions of criteria are likely to be dependent on culture and perspective. Identifying these criteria through focus group discussions with relevant stakeholders is probably a better approach to obtain a suitable set of criteria.

Thirdly, a number of studies relied solely on quantitative techniques, such as DCE, to elicit preferences of respondents. Where the advantage of such techniques is that its results can be applied across disease areas / interventions, their disadvantage is that not all criteria that are relevant to priority setting are amenable to quantification (not only ethical and social acceptability but also more practical considerations like intervention complexity) and these techniques then fall short of capturing these (36). A number of studies have used qualitative techniques such as deliberative processes. Such techniques have the advantage that

Table 2 Classification of the 18 included empirical priority setting studies in developing countries according to study methodology

Study	Study methodology					
	Respondents/ participants (number)		How to identify criteria	Identified criteria	Preference eliciting techniques	Presenting results
Teerawattananon and Russell (2008)	Policy actors (policy maker, hospital director, health worker and academics)	(38)	Literature review	Cost-effectiveness, severity of disease and treatment alternatives, equity of access improvement and financial impact on government budget	Semi-structured interview	Distribution of choices between the two case scenarios by type of respondents
Vargas and Poblete (2008)	None		Literature review	Burden of disease, inequity, effectiveness, delivery capacity of systems, costs, people's preference and cost-effectiveness	NA (secondary data analysis)	Ranking of 56 priority diseases and treatments
Lasry et al. (2008)	Policy maker (national, provincial, local) NGOs Academics	(35)	Literature review	(1) Prescriptive and current priority; (2) equity: (3) optimization, e.g. cost-effectiveness, total budget constraint, budget levels	Group discussion and interview	Ranking of HIV/AIDS interventions based on each of three approaches
Ottersen et al. (2008)	Policy maker	(63)	Group discussion including participants of the study	Life expectancy gains and average life-year benefit per patient	Group discussion and questionnaire (deliberative process) Group discussion	Ranking of the important reason in priority setting
Mshana et al. (2007)	District health planner Senior health staff General population Patients	(116)	NA	NA	Group discussion	Describe the participants' views
Makundi et al. (2007)	Policy maker Health worker General population People living with HIV/AIDS	(31) (23) (21) (10)	Literature review	Prevalence, disease burden, coverage of selected, conditions, severity of disease, efficacy, equity, and cost-effectiveness	Individual rating, group discussion and balance sheet method (deliberative process and reach consensus)	Rank ordering of the nine selected interventions (from an essential healthcare intervention package in Tanzania)

Table 2 (Continued)

Study	Study methodology					
	Respondents/ participants (number)		How to identify criteria	Identified criteria	Preference eliciting techniques	Presenting results
Rubinstein et al. (2007)	Policy maker (macro-, meso- and micro-level)	(20)	Focus group and interviews	Evidence-based clinical guidelines, individual impact and benefit, social impact and benefit, cost and consequences, available of resources and financial incentives	Focus group and interviews	List of criteria
Baltuseen et al. (2007)	Policy maker Health professionals	(7) (66)	Literature review and group discussion including participants of the study	Severity of disease, health benefits, age of target group, positive poverty reduction and cost-effectiveness	Individual rating and discrete choice experiment	Rank ordering of 33 interventions which address an important part of burden of disease in Nepal
Husain et al. (2007)	Policy maker	(10)	In-depth interview	Equity and efficiency	Interview	Describe policy maker's views
Madi et al. (2007)	Policy maker Head of organization Health worker	(21) (15) (45)	Self-administrated questionnaire and group discussion including participants of the study	National priorities, maternal mortality, quality of maternity care services, effectiveness and cost-effectiveness	Group discussion, questionnaire with rating questionnaire (deliberative process and reach consensus)	The first three most important of safe motherhood programme characteristics and the priority evaluation questions
Kapiriri et al. (2007)	Policy maker Health worker	(81) (103)	Interviews	Macro-level: political pressure, advocacy and international priorities Meso-level: historical budgets, volume of activity, emergencies and need Micro-level: medical and social worth (health state, expected benefit)	Semi-structured interview	Describing criteria for priority setting
Kapiriri & Martin (2006)	Policy maker Health worker	(14) (56)	One-on-one interviews	Strategic plan, evidence and need (in terms of the number of beds per directorate, medical emergencies and the patient load)	Interview and document analysis	Describing criteria for priority setting

Table 2 (Continued)

Study	Study methodology					
	Respondents/ participants (number)		How to identify criteria	Identified criteria	Preference eliciting techniques	Presenting results
Baltussen et al. (2006)	Policy maker	(30)	Group discussion including participants of the study	Cost-effectiveness, poverty reduction, age of target group, severity of disease, health effects and total budget impact	Individual rating and discrete choice experiment	Rank ordering of health interventions
Kapiriri & Norheim (2004)	Policy maker Health worker General population	(28) (320) (59)	Literature review and self-administrated questionnaire	Age of patients, cost-effectiveness, treatment costs, severity of disease and equity of access	Questionnaire with 6-point rating scale	List of criteria and their weights according to number of respondents who agreed criterion was important
Kapiriri et al. (2004)	Policy maker Health worker General population	(37) (326) (50)	Group discussion including participants of the study and interviews with international development partners and national level government officers	Cost-effectiveness, severity of disease, equality, costs of care, effectiveness of treatment/intervention, number affected, affects children, availability of effective intervention and preventable	Brain storming, interview and questionnaire (with 6-point rating scale and three scenarios)	Rank ordering of the criteria and respondent's choices in the three scenarios
Reichenbach (2002)	Policy maker Programme managers Academics, scientific and NGOs	(115)	Literature review, interview and analysis of media attention	Direct attention: incidence, mortality and morbidity data, disability-adjusted life years, actual costs, cost-effectiveness Process attention: direct and indirect measures of social and organizational capacity (e.g. budget, trainings, reports)Political attention: committee created, regional and district activities, funding sources, involvement of private/ NGO sectors and media attention	Interview and secondary data	Demonstrating the influence of political and organizational factors on priority

Table 2 (Continued)

Study	Study methodology				
	Respondents/ participants (number)	How to identify criteria	Identified criteria	Preference eliciting techniques	Presenting results
Hrabač et al. (2000)	None	NA	Vulnerable groups, ensuring safe motherhood and pregnancy, life-threatening conditions and the health of the entire population, preventive healthcare, prevention of high degree of disability, cost-effectiveness and efficiency	NA (secondary data analysis)	Describing criteria for priority setting
Söderlund (1999)	None	Literature review	The extent to which there was another appropriate responsible party who should pay for treatment, the urgency of required treatment, cost-effectiveness	NA (secondary data analysis)	Ranking of possible interventions included in an essential hospital package

NA, not available; NGO, Non-Government Organization

they are also able to address non-quantitative concerns and that they explicitly allow the inclusion of views of different stakeholders (37) and the reaching of consensus (36). The disadvantage is that its results are only relevant to the disease area/interventions under study and cannot be generalized across disease areas / interventions. Our suggestion then, is that quantitative techniques such as DCE may be relevant to situations where general guidance on priority setting is required and that qualitative techniques may be more apt in situations where more specific decisions are required on, e.g. implementation of certain interventions (cf. Murray et al. 2000 on the need for generalized vs. highly contextualized CEA). The added value of quantitative techniques such as DCE in the latter situation, e.g. to make decisions more transparent and explicit, is a topic for further research.

Finally, a number of studies presented their results in mere descriptive format such as identified criteria or respondents' preferences, whereas studies on priority setting have the intrinsic aim to rank-order interventions, or more specifically, to identify interventions that should be included or excluded from, e.g. public reimbursement (12). To the extent study objectives allow, we suggest studies to (also) present the impact of their findings in this respect.

Our study has a number of limitations. First, our review only included studies in English and incorporated in Medline and EMBASE (Ovid) databases. This may mean that 'grey literature' (such as government reports, unpublished reports, academic theses and conference proceedings) and publications in other languages were not identified from the search. Secondly, our classification of study methodologies may not be comprehensive and other methodological issues can also be important.

Reference

1. Ham C. Priority setting in health care: learning from international experience. Health Policy. 1997;42:49-66.
2. Klein R. Puzzling out priorities. Why we must acknowledge that rationing is a political process. British Medical Journal. 1998; 317:959-60.
3. Buse K. Keeping a tight grip on the reigns: donor control over aid coordination and management in Bangladesh. Health Policy and Planning. 1999;14:219-28.
4. Bryant J. Health priority dilemmas in developing countries. In: Coulter A, Ham C, editors. The Global Challenge of Health Care Rationing. Philadelphia: Open University Press; 2000. p. 63-73.
5. Goddard M, Hauck K, Preker A, Smith PC. Priority setting in health: a political economy perspective. Policy and Law 2006; 1:79-90.
6. Daniels N, Sabin J. Limits to health care: fair procedure, democratic deliberation, and the legitimacy problem for insurers. Philosophy and Public Affairs. 1997;26:303-50.
7. Klein R, Williams A. Setting priorities: what is holding us back inadequate information or inadequate institutions?. In: Coulter A, Ham C, editors. The Global Challenge of Health Care Rationing. Philadelphia: Open University Press; 2000. p. 15-26.
8. Cappenlen AW, Norheim OF. Responsibility, fairness and rationing in health care. Health Policy. 2006;76:312-9.
9. Norheim OF. Moving forward on rationing: a clinical view. British Medical Journal. 2008;337:903-4.
10. World Health Organization. CHOosing Interventions that are Cost Effective (WHO-CHOICE). 2008 [27 November 2008]; Available from: http://www.who.int/choice/description/en/
11. Kapiriri L, Martin DK. A strategy to improve priority setting in developing countries. Health Care Analysis. 2007;15:159-67.
12. Baltussen R, Niessen L. Priority setting of health interventions: The need for multi-criteria decision analysis. Cost Effectiveness and Resource Allocation. 2006;4:14.

13. Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJL. Measuring the global burden of disease and risk factors, 1990–2001. In: Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJL, editors. Global Burden of Disease and Risk Factor. New York: Oxford University Press; 2006. p. 1-13.
14. Jamison DT, Mosley WH, Measham AR, Bobadilla IL. Disease Control Priorities in Developing Countries. New York: Oxford University Press; 1993.
15. Evans DB, Lim SS, Adam T, Edejer TT. Achieving the millennium development goals for health: evaluation of current strategies and future priorities for improving health in developing countries. British Medical Journal. 2005;331:1457-61.
16. Baltussen R, Brouwer W, Niessen L. Cost-effectiveness analysis for priority setting in health: penny-wise but pound-foolish. International Journal of Technology Assessment in Health Care. 2005;21:532-4.
17. Naylor CD. Grey zones of clinical practice: some limits to evidence-based medicine. Lancet. 1995;345:840-2.
18. Holm S. The second phase of priority setting. Goodbye to simple solutions. British Medical Journal. 2000;317:1000-2.
19. Haudemaekers R, Dekkers W. Justice and solidarity in priority setting in health care. Health Care Analysis. 2003;11:325-43.
20. Benatar S. Priority setting: learning to make tough decisions. Journal of Neurology, Neurosurgery and Psychiatry. 2003;74:1185-6.
21. Teerawattananon Y, Russell S, Mugford M. A systematic review of economic evaluation literature in Thailand: are the data good enough to be used by policy makers? Pharmacoeconomics. 2007;25:467-79.
22. Makundi E, Kapiriri L, Norheim OF. Combining evidence and values in priority setting: testing the balance sheet method in a low-income country. BMC Health Services Research. 2007;7:152.
23. Kapiriri L, Arnesen T, Norheim OF. Is cost-effectiveness analysis preferred to severity of disease as the main guiding principle in priority setting in resource poor settings? The case of Uganda. Cost Effectiveness and Resource Allocation. 2004;2:1.
24. World Bank. 2008 list of developing countries. 2008 [1 March 2008];

Available from: http://www.aoac.org/meetings1/122nd_annual_mtg/list_developing_countries.pdf
25. Mubyazi GM, Mushi A, Kamugisha M, Massaga J, Mdira KY, Segeja M, et al. Community views on health sector reform and their participation in health priority setting: case of Lushoto and Muheza district, Tanzania. Journal of Public Health 2007;29:147-56.
26. Kapiriri L, Norheim OF, Heggenhougen K. Using burden of disease information for health planning in developing countries: the experience from Uganda. Social Science and Medicine. 2003;56:2433-41.
27. Makundi E, Manongi R, Mushi AK, Alilio MS, Theander TG, RØnn AM, et al. The use of nominal group technique in identifying community health priorities in Moshi rural district, northern Tanzania. Tanzania Health Research Bulletin 2005;7:133-41.
28. Rosato M, Mwansambo CW, Kazembe PN, Phiri T, Soko QS, Lewycka S, et al. Women's groups' perceptions of maternal health issues in rural Malawi. Lancet. 2006;368:1180-8.
29. Ottersen T, Mbilinyi D, Mæstad O, Norheim OF. Distribution matters: equity considerations among health planners in Tanzania.Health Policy. 2008;85:218-27.
30. Madi BC, Hussein J, Hounton S, Ambruoso LD, Achadi E, Arhinful DK. Setting priorities for safe motherhood programme evaluation: a paricipatory process in three devel¬oping countries. Health Policy. 2007;83:94-104.
31. Fleck LM. Just caring: Oregon, healthcare rationing and informed democratic deliberation. Journal of Medicine and Philosophy 1994;19:367-88.
32. Ham C, Coulter A. Explicit and implicit rationing: taking responsibility and avoiding blame for health care choices. Journal of Health Services Research and Policy. 2001;6:163-9.
33. Martin DK, Walton N, Singer PA. Priority setting in surgery: improve the process and share the learning. World Journal of Surgery 2003;27:962-6.
34. Vuorenkoski L, Toiviainen H, Hemminki E. Decision-making in priority setting for medicines – a review of empirical studies. Health Policy. 2008;86:1-9.

35. Musgrove P. Public spending on health care: how are different criteria related? Health Policy. 1999;47:207-23.
36. Gonzalez-Pier E, Gutie´rrez-Delgado C, Stevens G, Barraza-Llore´ns M, Porras-Condey R, Carvalho N, et al. Priority setting for health interventions in Mexico's system of social protection in health. Lancet. 2006;368:1608-18.
37. Green C, Gerard K. Exploring the social value of health-care interventions: a stated preference discrete choice experiment. Health Economics. 2009;18:951-76.

CHAPTER 3

A cost function analysis of Shigellosis in Thailand

Arthorn Riewpaiboon
Nutta Sreshthaputra
Seksun Samosornsuk
Lorenz von Seidlein
Sitaporn Youngkong
John F Stewart
Wanpen Chaicumpa
John D Clemens

Value in Health 2008; 11(Suppl1): S75 – S83

Abstract

Objective: The purpose of this study was to develop a cost function model to estimate the public treatment cost of shigellosis patients in Thailand.

Methods: This study is an incidence-based cost-of-illness analysis from a provider's perspective. The sample cases in this study were shigellosis patients residing in Kaengkhoi District, Saraburi Province, Thailand. All diarrhea patients who came to the health-care centers in Kaengkhoi District, Kaengkhoi District Hospital and Saraburi Regional Hospital during the period covering May 2002 to April 2003 were tested for *Shigella* spp. The sample for our study included all patients with culture that confirmed the presence of shigellosis. Public treatment cost was defined as the costs incurred by the health-care service facilities arising from individual cases. The cost was calculated based on the number of services that were utilized (clinic visits, hospitalization, pharmaceuticals, and laboratory investigations), as well as the unit cost of the services (material, labor and capital costs). The data were summarized using descriptive statistics. Furthermore, the stepwise multiple regressions were employed to create a cost function, and the uncertainty was tested by a one-way sensitivity analysis of varying discount rate, cost category, and drug prices.

Results: Cost estimates were based from 137 episodes of 130 patients. Ninety-four percent of them received treatment as outpatients. One-fifth of the episodes were children aged less than 5 years old. The average public treatment cost was US$8.65 per episode based on 2006 prices (95% CI, 4.79, and 12.51) (approximately US$1 = 38.084 Thai baht). The majority of the treatment cost (59.3%) was consumed by the hospitalized patients, though they only accounted for 5.8% of all episodes. The sensitivity analysis on the component of costs and drug prices showed a variation in the public treatment cost ranging from US$8.29 to US$9.38 (-4.20% and 8.43% of the base-case, respectively). The public treatment cost model has an adjusted R^2 of 0.788. The positive predictor variables were types of services

(inpatient and outpatient), types of health-care facilities (health center, district hospital, regional hospital), and insurance schemes (civil servants medical benefit scheme, social security scheme and universal health coverage scheme). Treatment cost was estimated for various scenarios based on the fitted cost model.

Conclusions: The average public treatment cost of shigellosis in Thailand was estimated in this study. Service types, healthcare facilities, and insurance schemes were the predictors used to predict nearly 80% of the cost. The estimated cost based on the fitted model can be employed for hospital management and health-care planning.

Keywords

cost function, public treatment cost, shigellosis

Introduction

A report made on shigellosis states that the global incidence of diarrhea has not declined through the years, although the same study reports that mortality resulting from it has declined. For children in developing countries under the age of five, the estimated annual mortality rate was 4.9 per 1,000 children. Diarrhea caused by Shigella accounts for a high percentage of this mortality. It was reported that an estimated 164.7 million Shigella episodes happened annually worldwide. Sixty-nine percent of these episodes involved young children [1]. Thailand is an Asian country with 62.2 million population based from 2005 survey. Generally, its health problems have shifted from communicable diseases to non-communicable diseases, with the notable exception of HIV/AIDS [2]. Based on the national reporting system, the incidence of acute diarrhea and dysentery was 1536, and 36 per 100,000 populations per year, respectively, in 2003. The causes of dysentery were unspecified pathogens (81%), culture-confirmed shigellosis (11%), and amoebas (8%) [3]. A population-based surveillance study conducted during 2000 to 2003 found that diarrhea incidence was 107.46 cases per 1,000 population per year, while the annual incidence of shigellosis was 10.4 per 1,000 population [4]. The disease is an alarming problem in children aged less than 5 years. Based on an active surveillance of this particular age group, the incidence rate was 64 cases per 1,000 population per year [5]. It is noteworthy to mention that though several international studies have been published on the economic aspects of enteric infections [6–11], no similar research has been published from Thailand. Recently, a health-care reform focusing on the health insurance system has been introduced in Thailand. Three major health insurance schemes operate in the country: the Social Security Scheme (SSS) for private employees, the Civil Servants Medical Benefit Scheme (CSMBS) for government servants, and the Universal Coverage of Health Care Scheme (UC) for the remaining two-thirds of the population. Payment methods for hospitals are capitation for the SSS and the UC, and fee-for-service for the CSMBS [12]. The newly introduced reform had an effect on hospital financing that resulted in unavoidable consequences to

patient services. To have an appropriate management of the disease in Thailand, there is a need to focus on the economic outcome. Hence, to analyze the cost of an illness is pivotal. Other than the average cost, cost function provides information that may help a decision-maker to determine whether or not a service should be implemented and/or reimbursed [13]. Economic information can be applied in both treatment and prevention. Because of the widespread isolation of strains that are resistant to multiple antibiotics, there are few treatment options. A vaccine to prevent illness and death caused by Shigella would be a valuable public health tool with a strong impact. There are some shigella vaccines currently under development with promising outcomes [1,14]. Nevertheless, economic evaluation is essential to include a vaccine into the vaccination program. Therefore, this study aims to develop a cost function model to estimate the public treatment cost of shigellosis patients in Thailand. This economic information could be useful for hospital management and public health planning in the future.

Methods

This study was designed as an incidence-based cost of illness study with a bottom-up approach [15]. Bottom-up or micro-costing approach is based on principles in which the actual services and then costs of individual patient are recorded and calculated. Costs were calculated from a provider perspective based on 2002 prices, and then adjusted to the 2006 prices using the medical care consumer price index [16]. The original Thai baht was converted to US$ at 38.084 baht per US$1 [17]. The costs in this study were economic (opportunity) costs, which are values of all resources used for producing services for the patients. The data were retrospectively collected. The study popultion was shigellosis patients from a surveillance project conducted on May 2002 to April 2003 [18]. The registered residents (39,594 males and 40,547 females)

of Kaengkhoi District, Saraburi Province 108 km north-east of Bangkok were the study population. There were 5,686 children aged less than 5 years and 74,455 adults [4]. Samples were collected from all diarrhea patients from the Kaengkhoi District who visited community health-care centers, the Kaengkhoi District Hospital, and the Saraburi Regional Hospital. These study health service facilities all belong to the government. Public hospitals are major health service settings in Thailand [19]. Rectal swap specimens were tested through the conventional culture method and dot-enzyme linked immunosorbent assay (Dot-ELISA) for shigella detection [20]. The surveillance found that the incidence of diarrhea among children less than 5 years was 122 cases per 1,000 population per year and 24.69 per 1,000 population per year among the population 5 years and older. The incidence of diarrhea patients was 31.59, whereas the incidence rate of shigellosis was 1.96 per 1,000 population per year [18].

All shigellosis patients detected during the study period were included in the study. The study included in and outpatients of both genders and all age groups. The variables included in this study were demographic characteristics(sex, age, and health insurance scheme), service utilization (hospital services, pharmacy cost, and other medical services for diagnosis and treatment), and direct medical cost or public treatment cost. Treatment costs also included complications and sequelae for up to 90 days after presentation [4], but did not include costs associated with comorbidity. Descriptive statistics were used to summarize demographic characteristic, service utilization, and cost. Univariate sensitivity analysis was used to explore the uncertainty of the results [21]. Likewise, variations in discount rate, prices of drugs, and opportunity cost of land use were analyzed. The drug prices were the minimum and maximum prices reported to the Ministry of Public Health by public hospitals. The stepwise multiple regression analysis [22] was employed to analyze the relationship between the public treatment cost (dependent variable) and potential explanatory variables (independent variables). Assumption and model diagnostics were also explored. Independent variables with a probability value of F statistics = 0.05 in the analysis were entered. To estimatethe expected response on an untransformed scale after fitting a

linear regression model of transformed scale, it needs to be adjusted by the smearing factor [23]. To retransform the predicted log of cost, the following equation was applied [24].

$$E(\text{cost}) = \left[e_0^{(x\beta)}\right]\left[\frac{1}{n}\sum_{i=1}^{n} e^{S_i}\right] \quad (1)$$

$$\frac{1}{n}\sum_{i=1}^{n} e^{S_i} = \text{smearing factor} \quad (2)$$

where e^{Si} = antilog (exponential) form of the unstandardized residual.

The public treatment cost was calculated from the provider's perspective; in this case, the health facilities under the responsibility of the Ministry of Public Health. Saraburi Hospital has 680-bed and 1,686 staff members providing tertiary hospital care on a provincial/regional level. Kaengkhoi Hospital is a 60-bed district hospital with 146 staff members providing secondary hospital care for the Kaengkhoi District. Health centers are public health-care facilities at the sub-district level that provide primary health care, health promotion, and prevention (no inpatient service). The usual staff members include between two to six nurses and/or paramedics. All 19 health centers in the Kaengkhoi District participated in this project. The public treatment costs are defined as the direct medical costs at these health centers, as well as in Kaengkhoi Hospital and Saraburi Hospital. Cost analysis started from a calculation of the unit cost of the medical services of all facilities [25,26]. Unit cost analysis was calculated employing the same methods. The calculation consisted of five steps, organization analysis and cost center classification, direct cost determination, indirect cost determination, full cost determination, and calculation of unit cost of medical services [27,28]. The health service settings were categorized into patient care and non-patient care cost centers. Direct cost determination of each cost center consisted of capital, labor, and material costs. Capital cost consists of two components,

namely capital costs of capital items and opportunity costs of land and stocked materials. Capital costs of buildings and capital items were calculated as equivalent annual economic costs [25,29]. Following WHO recommendations, a 3% discount rate was selected [30]. A lifespan of 20 years for building and constructions and 5 years for the rest of the capital items were used [31,32]. Labor cost includes the sum of salaries, wages, incentives, and fringe benefits, such as accommodation, training expenses, health-care expenses, and education expenses. Materials covered were drugs, chemicals, office materials,and utilities. For the hospitals, the costs of all supporting departments or non-patient care cost centers were allocated to production departments or patient care cost centers that employed a simultaneous allocation method [25]. Services or outputs of supporting cost centers were selected as allocation criteria for the allocation (e.g., number of staff for administration department). The average method [33,34] was used to calculate the unit cost of services of the departments producing one cost product or various homogeneous products in terms of resource consumption, such as outpatient visit, inpatient day, and drug dispensing. On the other hand, the micro-costing method [34,35] was used for the unit cost calculation of the departments that had various cost products and consumed different resources (e.g., laboratory, radiology, physical therapy, operating room, emergency room). Micro-costing is a method that allocates the cost of the production cost center to each unit of service. First, resources directly consumed by each unit of service were valued. Then, shared cost was allocated to the services in proportion to the direct cost of the services.

Results

The unit costs of medical services provide by Saraburi Hospital were higher than those of the Kaengkhoi Hospital except for some laboratory investigations (Table 1). For the health centers, consultation and drug

dispensing were averaged to be the cost of outpatient service, which varied from US$1.21 to US$3.83. Some of these were higher than those of the Kaengkhoi Hospital. Regarding the drug cost, they were the hospitals' purchasing prices. Frequently used drugs are listed in Table 2.

The minimum and maximum prices were the prices that the public hospitals reported to the Ministry of Public Health. Variations between the minimum and maximum prices were in the range of 1.7 (5% dextrose solution) to 13.7 times (norfloxacin 100 mg).

Table 1 Unit cost of some medical services (US$ at 2006 prices)

Service	Unit	Unit cost		
		Saraburi hospital	Kaengkhoi hospital	Health centers
Routine service: outpatient*	Visit	7.24	2.17	1.21 – 3.83
Routine service: female ward	Patient day	22.29	19.56	n/a
Routine service: male ward	Patient day	n/a	21.82	n/a
Drug dispensing for outpatient	Prescription	5.37	0.57	n/a
Drug dispensing for outpatient†	Prescription	1.65	n/a	n/a
Complete blood count (CBC)	Test	1.84	1.70	n/a
Blood urea nitrogen (BUN)	Test	0.54	3.60	n/a
Creatinine	Test	0.50	3.02	n/a
Stool exam	Test	0.46	1.60	n/a
Urine analysis (UA)	Test	0.70	2.03	n/a
Occult blood	Test	0.65	1.60	n/a

*For Saraburi Hospital, it is a service at the emergency room. For health centers, the cost per visit is presented as a range of all health centers included in the study.
†For Khaengkhoi Hospital, outpatients and inpatients receive drug dispensing from the same unit.

Table 2 Cost of drugs per 100 units (US$ at 2006 prices)

Drug	Unit cost		
	Base-case	Minimum	Maximum
Norfloxacin 100 mg tablet	1.68	0.84	11.49
Norfloxacin 400 mg tablet	2.74	1.57	6.43
Ciprofloxacin 250 mg tablet	9.84	2.80	9.84
Domperidone tablet	0.87	0.28	1.17
Hyoscine-n-butyl bromide tablet	4.08	1.40	4.08
Metoclopramide 5 mg tablet	0.50	0.39	0.70
Paracetamol 500 mg tablet	0.34	0.21	0.89
ORS adult sachet	7.55	2.80	13.42
ORS pediatric sachet	4.75	2.66	10.07
5% Dextrose in ½ normal saline solution 1000 ml bag	44.74	41.75	71.31
Normal saline solution 1000 ml bag	46.14	38.87	167.51

Patient Characteristics and Service Utilization

All shigella-positive cases were included. There were 137 episodes from 130 patients. Out of 140 outpatient visits, most patients received treatment at Kaengkhoi Hospital (94 visits), followed by 46 visits at the health centers. For the hospitalization treatment, there were nine and three admissions at Kaengkhoi Hospital and Saraburi Hospital, respectively. Nearly all patients (94.2%) received treatment as outpatients (Table 3), while 6% of patients were hospitalized. More than half of the patients were female (63.5%). Majority of the patients (61.3%) were aged more than 15 years. The largest percentage of patients was treated at Kaengkhoi Hospital (65%). The antibiotics used were norfloxacin, ciprofloxaxin, cotrimoxazole, and tetracycline.

Table 3 Variables included in the regression analysis

Variable	Definition and characteristics	Codes and values
Dependent variables LNCOST	Natural log of public treatment cost per episode	Number in Ln form of the cost
Independent variables ADULT	Age of patients	1= adult; aged more than 15 years (61.3%), 0= children; aged 1-15 years (38.7%)
Dummy variables for health providers; health centers (31.3%) as reference		
KH	Kaengkhoi Hospital (65%)	1= Kaengkhoi Hospital, 0= else
SR	Saraburi Hospital (1.5%)	1= Saraburi Hospital, 0= else
HCKH	Health center and Kaengkhoi Hospital (2.2%)	1= Health center and Kaengkhoi Hospital, 0= else
Dummy variables for service type; outpatient (94.1%) as reference		
IP	Inpatient (2.2%)	1= Inpatient service, 0= else
OPIP	Outpatient and inpatient (3.6%)	1= Outpatient and inpatient service, 0= else
Dummy variables for payment status; Universal Coverage Scheme (45.3%) as reference		
SSS	Social Security Scheme (21.9%)	1= Social Security Scheme, 0= else
CSMBS	Civil Servant Medical Benefit Scheme (4.4%)	1= Civil Servant Medical Benefit Scheme, 0= else
OOP	Out-of-Pocket (5.8%)	1= Self payment, 0= else

Public Treatment Cost

Public treatment cost was defined as the sum of the cost of visit, cost of hospitalization, dispensing cost, drug cost, cost of medical devices, and laboratory cost. The average cost per episode was US$8.65. Hospitalizations consumed a major part of the overall costs of shigellosis treatment. There were only 5.8% of episodes that received hospitalization services, but they consumed more than half of the total public treatment costs. This was around 59.3% of the total cost (Table 4). Regarding the types of services, the routine service or hotel cost for inpatients consumed nearly half (46%) of the total cost. The routine service of outpatient and pharmacy cost (drug cost and drug dispensing cost) were approximately one-fourth (Table 4).

Table 4 Descriptive data of public treatment costs by category of costs and services (US$ at 2006 prices)

Cost	Mean	95% CI		Median
		Lower	Upper	
Cost by category				
Routine service for outpatient	2.19 (25.1%)	2.04	2.34	2.17
Routine service for inpatient	4.01 (46.36%)	0.91	7.11	0.00
Drug dispensing cost	0.89 (10.29%)	0.47	1.31	0.57
Drug cost	1.06 (12.27%)	0.76	1.37	0.66
Medical devices	0.09 (1.00%)	0.02	0.15	0.00
Laboratory	0.41 (4.77%)	0.15	0.68	0.00
Total medical cost	8.65 (100%)	4.79	12.51	3.42
Cost by service (% of sample, % of total cost)				
Outpatient visit (91.3%, 37.0%)	3.51	3.21	3.81	3.35
Inpatient admission (1.5%, 10.7%)	63.25	-433.37	559.87	63.25
Outpatient+inpatient*(3.6%, 41.5%)	98.44	30.32	166.57	84.57
Multivisits (2.9%, 3.7%)	10.96	-3.52	25.43	6.60
Multiadmissions (0.7%, 7.1%)	84.04	n/a	n/a	n/a
Cost by age group (% of sample)				
Aged less than 5 years (20.4%)	6.22	0.255	12.19	3.20
Aged 5-15 years (18.3%)	9.24	-1.63	20.10	3.34
Aged more than 15 years (61.3%)	9.29	4.09	14.50	3.56
Total (100%)	8.65	4.79	12.51	3.42

*One visit and one admission.

Sensitivity Analysis

To explore variations of the public treatment cost of shigellosis, some cost drivers (i.e., cost structure, discount rate, and prices of drugs) were varied in repeated calculations. The base case included opportunity of land used and a 3% discount rate. The following scenarios were employed in a one-way sensitivity analysis:

1. base case: 3% discount with cost of land use;
2. 3% discount rate for capital costing, excluding opportunity cost of land used 3%NoLand);
3. 6% discount rate for capital costing, including opportunity cost of land used (6%Land);
4. 6% discount rate for capital costing, excluding opportunity cost of land used (6%NoLand);

5. 3% discount rate for capital costing, including opportunity cost of land used and substitution drug prices of base case by minimum prices (3%LandMinPrice); and
6. 3% discount rate for capital costing, including opportunity cost of land used and substitution drug prices of base case by maximum prices (3%LandMaxPrice).

The total medical cost (or public treatment cost) ranged from US$8.29 per episode (-4.20%) to US$9.38 per episode (+8.43%) because of the different assumptions for drug prices. (Table 5).

Table 5 Results of sensitivity analysis; treatment cost per episode (US$ at 2006 prices)

Scenario	Average treatment cost	Variation from base case (%)
1. Base case; 3% Land	8.65	n/a
2. 3% NoLand	8.50	-1.78%
3. 6% Land	9.05	4.60%
4. 6% NoLand	8.74	1.05%
5. 3% LandMinPrice	8.29	-4.20%
6. 3% LandMaxPrice	9.38	8.43%

Public Treatment Cost Function

Potential predictor variables included in the model tested are presented in Table 3. Because of the non-normal distribution of institutional costs, a log transformation [36] was applied and a linear relationship among variables was tested. For further assumption tests and model diagnosis, the scattered plot of residuals against the predicted values and all independent variables shows no funnel shape indicating homoscedasticity [22]. The condition index was 1 to 3.401.

This meets the criteria of ≤ 30; hence, indicating no multico-linearity [22]. The final fitted model has a determination coefficient equal to the adjusted $R^2 = 0.788$, with a significance level = 0.000. The significant variables and regression coefficients are shown in Table 6. The smearing factor of the public treatment cost model was 1.0827.

Table 6 Regression model of public treatment cost

	Unstandardized coefficients				95% CI for β	
	β	Std. error	t	Sig.	Lower bound	Upper bound
(Constant)	0.877	0.058	15.075	0.000	0.762	0.992
Outpatient and inpatient	2.970	0.165	18.043	0.000	2.644	3.295
Inpatient	1.916	0.215	8.906	0.000	1.491	2.342
Kaengkhoi Hospital	0.453	0.072	6.315	0.000	0.311	0.595
Saraburi Hospital	1.087	0.300	3.623	0.000	0.493	1.680
Civil Servant Medical Benefit Scheme	0.406	0.170	2.388	0.018	0.070	0.742

Based on the fitted model, the predicted public treatment cost of a patient who received treatment at a health center as an outpatient and is not under CSMBS, is calculated as follows:

$$\text{LNCOST} = 0.877 + 2.970\text{opip} + 1.916\text{ip} + 0.453\text{kh} + 1.087\text{sr} + 0.406\text{csmbs} \quad (3)$$

$$\text{LNCOST} = 0.877 + 2.970\text{x0} + 1.916\text{x0} + 0.453\text{x0} + 1.087\text{x0} + 0.406\text{x0} \quad (4)$$

$$\text{LNCOST} = 0.877 \quad (5)$$

$$\text{Public treatment cost per episode} = e^{0.877} \times 1.0827 \quad (6)$$

$$\text{Public treatment cost per episode} = \text{US\$2.60} \quad (7)$$

Based on the fitted model, the predicted public treatment costs of various scenarios were calculated as shown in Table 7.

Discussion

In view of the general results of our study, we could state that the results could represent most shigellosis patients in Thailand. We selected two types of public hospitals that represent the majority of public hospitals in Thailand. This is important, considering that public hospitals are major health service settings in Thailand. The patient beds of public hospitals are approximately 80% of the total beds in Thailand [19].

Table 7 Predicted public treatment cost from the fitted model (US$ at 2006 prices)

Scenario	Outpatient	Inpatient	HC	KH	SH	CSMBS	Cost	%change*
1	yes	no	yes	no	no	no	2.60	n/a
2	yes	no	no	yes	no	no	4.10	57%
3	yes	no	no	yes	no	yes	6.15	136%
4	yes	no	no	no	yes	no	7.72	196%
5	yes	no	no	no	yes	yes	11.58	345%
6	no	yes	no	yes	no	no	82.52	3070%
7	no	yes	no	yes	no	yes	123.80	4656%
8	no	yes	no	no	yes	no	52.44	1915%
9	no	yes	no	no	yes	yes	78.68	2923%

*% change from scenario one.
CSMBS, Civil Servant Medical Benefit Scheme; HC, Health Center; KH, Kaengkhoi Hospital; SH, Saraburi Hospital

Both selected hospitals had an indication of efficient production. The occupancy rates of inpatient beds were nearly 100%, even as World Health Organization guidelines recommend conducting cost analysis at 80% capacity utilization [30]. Another indicator of representativeness is resource utilization. The proportion of capital cost was 17.8% at Kaengkhoi Hospital and 23.47% at Saraburi Hospital, while studies in

other hospitals were 14.73% to 15.38% in the district hospitals [37,38], and 15.89% to 22.21% in the regional hospitals [39,40], These are slightly less than those of the study hospitals because they were not included opportunity cost of the stocked materials. For the unit cost analysis, this study employed micro-costing technique in the allocation of cost from the cost center to the individual service output. This method is the most accurate [27, 41]. Nevertheless, the unit cost of similar medical services in varied settings can be different. There can be variation of unit cost estimates [41]. In this study, we have controlled costing methods by using the same methods among the study settings. In this way, variations can only happen as a result of the gap between the resources used and service outputs produced. In our study, the unit costs of some laboratory tests at Kaengkhoi Hospital were higher than those of the Saraburi Hospital. Generally, a district hospital provides secondary care while a regional hospital provides tertiary care. They have different equipments, as well as varying qualifications and number of staff members. Consequently, they vary in their capital and labor costs. In addition, they may provide a different number of services. In this situation, the unit costs of similar simple services can be different because of the unit fixed cost. Another factor that affects treatment cost is the prescribing pattern. We found that the antibiotics used in this study were similar to other studies [42]. Hence, the results from this study could be used in the estimation of the country cost.

In terms of hospital management, the information on cost structure is pivotal for cost management. Eight out of 137 episodes (5.8%) consumed a cost of 59.3% of the total treatment costs. This means that hospitalizations consumed a major part of the public treatment cost. Therefore, it is essential to control the number of admissions in order to contain the costs. Unfortunately, the number of inpatients was too small in this study to explore the factors leading to hospitalizations. Furthermore, the sensitivity analysis shows a considerable effect of drug prices on public treatment costs. Although drugs exclusive

of dispensing costs accounted for only 12% of the public treatment cost (Table 4), drug prices affected the total cost in the range of -4.20% and +8.43% (Table 5). In Thailand, like in many low-income countries, drug prices vary considerably, and our findings may therefore be of wider interest. Therefore, the drug supply in hospitals is a target of cost containment. To know more about the details of cost drivers, the cost function method may be used to help provide such information [13]. The public treatment cost model with the adjusted R^2 of 0.788 was statistically significant as predicted by types of services (outpatient and inpatient), types of providers (health center, district hospital, regional hospital), and health insurance scheme. This fitted model could be reliable because the model could explain the treatment cost by nearly 80%. The effect of the health service level on the treatment cost can also be explained. Generally, the unit costs per visit increased from the health centers to the district hospital and then to the regional hospital. In addition, there was no inpatient service at the health centers. Therefore, the average total cost of public treatment at the health centers was less than those of the hospitals. Another predictor of the public treatment cost was the insurance scheme of patients. For example, CSMBS patients tended to receive drugs with higher cost (they take brand name drugs instead of generic drugs) and longer hospitalization. The CSMBS is a fee-for-service payment scheme, while the other insurance schemes are capitation schemes. This results to a scenario of unequal treatments among patients with different payment schemes. This is related to the issue of equity in health and needs to be further investigated.

Based on the stepwise method that was used, we concluded that there is no difference in the treatment cost between adults and children. Because admission is a significant factor, we tested and found that there is no statistically significant difference in the rates of admission between adults and children (Fisher's exact test; $P = 0.297$). Another factor that might have affected the difference in the public treatment costs of adults and children was drug cost.

Nevertheless, Table 4 shows that drugs exclusive of dispensing costs accounted for only 12% of the public treatment cost. This proportion might not be big enough to affect the public treatment cost. Various scenarios according to service types, providers, and health insurance schemes show high variations in cost. As shown in Table 7, for the same condition, patients treated at health centers were able to save as much as US$1.5 per episode in comparison with those treated at the district hospital (scenario 1 versus 2 in Table 7). The treatment cost increased to 2,923% from that of the health center. The treatment cost function is useful because it provides an estimated quantity of cost difference among the various scenarios. In the future, this would be applicable in feasibility studies on health interventions. Nevertheless, the consequences for the quality of treatment should be further investigated.

Based on the results of this study and the overall incidence of shigellosis in 10.4 per 1,000 population per year [4], the annual cost because of shigellosis in Thailand is estimated at US$5.60 million. Bearing this in mind, the priority setting of the country's public health planning could be affected. Furthermore, costing studies can be applied to the design of interventions. Generally, the cost and outcome of interventions should be estimated during planning. The economic outcome is one of the most important factors to take into consideration. Cost-benefit is an alternative evaluation method. The number of illness that could be avoided with information on the cost of illness can be used in the calculation of savings to compare the intervention cost. In the same district where this study was conducted, another study was done on the risk factors of shigellosis. This particular study showed that hygiene behaviors such as regular hand washing, a clean household and environment, and the availability of water to flush the toilet were associated with a reduced risk for shigellosis in the multivariate model [43]. If an intervention such as hand washing is targeted to reduce shigellosis by 10%, this can produce a savings of US$0.56 million. In terms of the project design, the cost of the intervention should not be higher than the amount of the

expected savings.

Another interesting intervention is vaccination. The information from our studies and others similar to it could be useful for vaccine development. The success of vaccination does not solely depend on the development of a vaccine, but also on its wide coverage. One of the factors that affect vaccination compliance is affordability. If we have information on an affordable price, it could have an effect on the development of a production technique that relates to the targeted prices. Currently, there are some shigellosis vaccines under development [1, 14]. Information on treatment cost from this study and previous epidemiological studies, including further estimation of vaccine delivery cost, can be used in a modeling design of cost-effectiveness analysis (CEA) [44] for a shigella vaccine. The analysis can be performed for all age groups or high-risk groups whose age are less than 5 years old [5]. The fitted model provided an estimated cost of treatment at various settings. This can be useful for a CEA in a specific geographic area. For example, we may implement the vaccination only in a high-incidence area. This area may have a different proportion of treatment among health center and the hospital. Based on the costs between the health center and the hospital, as shown in Table 7, we can calculate the weighted average treatment cost in that area for the CEA. In addition, the threshold analysis [45,46] method may be used to show the break-even price of the vaccine. This price can be one of the targets for vaccine development.

Conclusion

The average public treatment cost of shigellosis in Thailand was determined to be US$8.65 per episode. Approximately 6% of these episodes consumed 60% of the total cost. Service types, health-care

facilities, and insurance schemes were predictors of nearly 80% of the cost. The estimated cost can be employed for hospital management and health problem priority setting and planning. The fitted cost model was useful in estimating the treatment cost of various scenarios.

These estimated costs can be applied in a feasibility study of health interventions. Furthermore, it can be useful information for vaccine development.

Reference

1. Future needs and directions for Shigella vaccines. Wkly Epidemiol Rec 2006;6:51–8.
2. The Thai Working Group on burden attributable to risk factors MoPH. Thailand's Risk Burden in 1999. Bangkok: Bureau of Health Policy and Planning, Ministry of Public Health, 2004.
3. Epidemiology Bureau Ministry of Public Health. Annual Epidemiological Surveillance Report 2003. Available from: http://epid.moph.go.th/ [Accessed July 13, 2005].
4. Chompook P, Samosornsuk S, von Seidlein L, et al. Estimating the burden of shigellosis in Thailand: 36-month population-based surveillance study. Bull World Health Organ 2005;83:739–46.
5. Lee H, Kotloff K, Chukaserm P, et al. Shigellosis remains an important problem in children less than 5 years of age in Thailand. Epidemiol Infect 2005; 133:469–74.
6. Chen KT, Fan SF, Tang RB, et al. Hospital-based study of the economic burden associated with rotavirus diarrhea in Taiwan. Vaccine 2007;25:4266–72. Epub 2007 Mar 7.
7. Fischer TK, Anh DD, Antil L, et al. Health care costs of diarrheal disease and estimates of the cost-effectiveness of rotavirus vaccination in Vietnam. J Infect Dis 2005;192:1720–6.
8. Nelson EA, Tam JS, Yu LM, et al. Hospital-based study of the economic burden associated with rotavirus diarrhea in Hong Kong. J Infect Dis 2005; 192(Suppl. 1):S64–70.
9. Ehrenkranz P, Lanata CF, Penny ME, et al. Rotavirus diarrhea disease burden in Peru: the need for a rotavirus vaccine and its potential cost savings. Rev Panam Salud Publica 2001;10:240–8.
10. Zimmerman CM, Bresee JS, Parashar UD, et al. Cost of diarrhea-associated hospitalizations and outpatient visits in an insured population of young children in the United States. Pediatr Infect Dis J 2001;20:14–9.
11. Thomson MA, Booth IW. Treatment of traveller's diarrhoea. Economic aspects. Pharmacoeconomics 1996;9:382–91.
12. National Health Security Office. Annual Report 2003. Bangkok:

National Health Security Office of Thailand, 2004.
13. Brouwer W, Rutten F, Koopmanschap M. Costing in economic evaluations. In: Drummond M, McGuire A, eds. Economic Evaluation in Health Care—Merging Theory with Practice. New York: Oxford University Press, 2001.
14. Oaks EV, Turbyfill KR. Development and evaluation of a Shigella flexneri 2a and S. sonnei bivalent invasion complex (Invaplex) vaccine. Vaccine 2006;24:2290–301.
15. Kobelt G. Health Economics: An Introduction to Economic Evaluation (2nd ed.). London: Office of Health Economics, 2002.
16. Bank of Thailand. Consumer price index by group. Available from: http://www.bot.or.th/bothomepage/databank/EconData/EconFinance/Download/Tab77.xls [Accessed April 20, 2007].
17. Bank of Thailand. Foreign exchange rates. Available from: http://www.bot.or.th/bothomepage/databank/FinMarkets/ExchangeRate/exchange_e.asp [Accessed February 5, 2007].
18. Samosornsuk S. The Burden of Shigellosis and Molecular Characteristics of Shigella spp. Isolated in Kaeng-khoi District, Saraburi Province, Thailand [PhD. in Biomedical Sciences]. Bangkok: Thammasart University, 2006.
19. Alpha Research, ed. Thailand Public Health 2006–2007. Nonthaburi: Alpha Research, 2006.
20. Sonjai K, Soisangwan R, Sakolvaree Y, et al. Validation of salmonellosis and shigellosis diagnostic test kits at a provincial hospital in Thailand. Asian Pac J Allergy Immunol 2001;19: 115–27.
21. Manning WG, Fryback DG,Weinstein MC. Reflecting uncertainty in cost-effectiveness analysis. In: Gold MR, Sigel JE, Russell LB, et al., eds. Cost-Effectiveness in Health and Medicine. Oxford: Oxford University Press, 1996.
22. Cohen J, Cohen P, West SG, et al. Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates, Inc., 2003.
23. Duan N. Smearing estimator: a nonparametric retransformation method. J Am Stat Assoc 1983;78: 605–10.
24. Smith M, Barnett P. What is retransformation bias, and how can

it be corrected? Available from: http://www.herc.research.med.va.gov/faqE2_retransformation. pdf [Accessed August 5, 2005].
25. Drummond M, O'Brien BJ, Stoddart GL, et al. Method for the Economic Evaluation of Health Care Programmes (2nd ed.). Oxford: Oxford University Press, 1997.
26. Rigden MJ. Health Service Financial and Accounting. London: Heinenann, 1983.
27. Riewpaiboon A, Malaroje S, Kongsawatt S. Effect of costing methods on unit cost of hospital medical services. Trop Med Int Health 2007;12:554–63.
28. Shepard DS, Hodgkin D, Anthony YE. Analysis of Hospital Costs: A Manual for Managers. Geneva: World Health Organization, 2000.
29. Kumaranayake L. The real and the nominal? Making inflationary adjustments to cost and other economic data. Health Policy Plan 2000;15:230–4.
30. Edejer TT-T, Baltussen R, Adam T, et al. Making Choices in Health: WHO Guide to Cost-Effectiveness Analysis. Geneva: World Health Organization, 2003.
31. Creese A, Parker D. Cost Analysis in Primary Health Care: A Training Manual for Programme Managers. Geneva: World Health Organization, 2000.
32. Disyathikom K, Pacharanarumol W, Tangcharoensathien V. A Manual of District Hospital Cost Analysis (in Thai Language). Bangkok: International Health Policy Planning, 2001.
33. Finkler SA. The distinction between cost and charges. Ann Intern Med 1982;96:102–9.
34. Suver JD, Cooper JC. Principles and methods of managerial cost-accounting systems. Am J Hosp Pharm 1988;45:146–52.
35. Leaner WM, Wellman WL, Burik D. Pricing hospital units of service using microcosting techniques. Hosp Health Serv Adm 1985;30:7–28.
36. Zhou X-HA, Ramsey S. Assessing the equality of means of healthcare costs. Expert Rev Pharmacoeconomics Outcomes Res 2003;3:561–7.

37. Riewpaiboon A, Piyauthakit P, Chaikledkaew U. Economic burden of road traffic injuries: a micro-costing approach. 2008:(submitted).
38. Assavasamrit N. Unit Cost of Outpatient and Inpatient Services at Lomkao Crown Prince Hospital, Petchaboon Province Fiscal Year 1998 [Master of Science in Pharmacy (Hospital Pharmacy)]. Bangkok: Mahidol University, 1999.
39. Riewpaiboon A, Jaroenkitpan N, Wipaswacharayotin Y. Cost structure of hospital-based pharmaceutical services: a consideration of reimbursement. Mahidol Univ J Pharm Sci 2005;32:47–54.
40. Youngkong S, Riewpaiboon A, Towanabut S, et al. Unit cost of medical services at Prasat Neurological Institute. Srinakarinwirot J Pharm Sci 2004;9:52–8.
41. Mogyorosy Z, Smith P. The Main Methodologyical Issues in Costing Health Care Services; a Literature Review. York: Centre for Health Economics, The University of York, 2005.
42. Bhattacharya SK, Sur D. An evaluation of current shigellosis treatment. Expert Opin Pharmacother 2003;4:1315–20.
43. Chompooka P, Todd J, Wheeler JG, et al. Risk factors for shigellosis in Thailand. Int J Infect Dis 2006; 10:425–33.
44. Torrance GW, Siegel JE, Luce BR. Framing and designing the cost effectiveness analysis. In: Gold MR, Sigel JE, Russell LB, et al., eds. Cost-Effectiveness in Health and Medicine. Oxford: Oxford University Press, 1996.
45. Agro KE. Sensitivity analysis in health economic and pharmacoeconomic studies: an appraisal of the literature. Pharmacoeconomics 1997;11:75–88.
46. Briggs A, Sculpher M. Sensitivity analysis in economic evaluation: a review of published studies. Health Econ 1995;4:355–71.

CHAPTER 4

Criteria for priority setting of HIV/AIDS interventions in Thailand: A discrete choice experiment

Sitaporn Youngkong
Rob Baltussen
Sripen Tantivess
Xander Koolman
Yot Teerawattananon

BMC Health Service Research 2010; 10; 197

Abstract

Introduction: Although a sizeable budget is available for HIV/AIDS control in Thailand, there will never be enough resources to implement every programme for all target groups at full scale. As such, there is a need to prioritise HIV/AIDS programmes. However, as of yet, there is no evidence on the criteria that should guide the priority setting of HIV/AIDS programmes in Thailand, including their relative importance. Also, it is not clear whether different stakeholders share similar preferences.

Methods: Criteria for priority setting of HIV/AIDS interventions in Thailand were identified in group discussions with policy makers, people living with HIV/AIDS (PLWHA), and community members (i.e. village health volunteers (VHVs)). On the basis of these, discrete choice experiments were designed and administered among 28 policy makers, 74 PLWHA, and 50 VHVs.

Results: In order of importance, policy makers expressed a preference for interventions that are highly effective, that are preventive of nature (as compared to care and treatment), that are based on strong scientific evidence, that target high risk groups (as compared to teenagers, adults, or children), and that target both genders (rather than only men or women). PLWHA and VHVs had similar preferences but the former group expressed a strong preference for care and treatment for AIDS patients.

Conclusions: The study has identified criteria for priority setting of HIV/AIDS interventions in Thailand, and revealed that different stakeholders have different preferences vis-à-vis these criteria. This could be used for a broad ranking of interventions, and as such as a basis for more detailed priority setting, taking into account also qualitative criteria.

Keywords

priority setting, discrete choice experiment, HIV/AIDS interventions

Introduction

While the number of new HIV positive cases in Thailand decreases [1-3], HIV/AIDS continues to take a large toll in the country with 610,000 prevalent cases and approximately 30,000 deaths in 2007 [2]. A wide array of HIV/AIDS control programmes has been implemented to confront the epidemic since the first wave of infections in the mid-1980s [1, 4]. Thailand's current national plan for HIV/AIDS prevention and alleviation, 2007–2011 [3] aims to: (i) integrate AIDS prevention, care, treatment, and impact reduction implementation into service provision at all levels; (ii) strengthen community's education about AIDS; (iii) enhance capacity of local administration in taking responsibility on local HIV/AIDS interventions; and (iv) prevent HIV transmission among children in schools and high-risk population groups. To date, the Thai government provides universal coverage for antiretroviral medication to all eligible people living with HIV/AIDS (PLWHA) [5]. However, HIV-related absenteeism and the need of informal care (e.g. care givers) have notable effects on individual PLWHA's economic burden [6].

Although a sizeable budget for implementation of this plan is available - approximately US$193 million in 2008 derived from both the Thai government and the International Monetary Fund [3] - there will never be enough resources to implement every programme for all target groups at full scale. As such, there is a need to prioritise HIV/AIDS programmes within the available budget, and to decide on which programmes will receive funding and which programmes will not.

A number of criteria can guide this priority setting process [7]. First, cost-effectiveness, or efficiency, aims to maximize population health given a certain budget. A limited number of cost-effectiveness analyses have been performed in Thailand [8], including (i) routine offer of HIV counseling and testing [9]; (ii) donated blood screening by nucleic acid testing [10]; (iii) HIV vaccination [11], and (iv) the prevention programme of mother-to-child transmission of HIV [12]. Secondly, equity or fairness, aims to minimize differences in health among population groups, with

special reference to the severely ill, disadvantaged, or vulnerable populations [13]. Thirdly, the Thai government may hold preferences to target specific population groups, because they are more deserving of health care than others. The HIV/AIDS epidemics in Thailand concerns various population groups, including high-risk groups such as male homosexuals, intravenous drug users, and low-risk groups as the general population including teenagers, adults, and elderly [4, 14]. In addition, a wide range of other medical (e.g. preference for acute care in life threatening situation) and non-medical criteria (e.g. preferences for programmes with desirable social consequences) may play a role in priority setting process [7, 14-17].

It is clear that relying on a single criterion, e.g. efficiency, falls short to capture the important moral and ethical notions, and is unlikely to be acceptable for most policy makers [18-21] including those in Thailand [22]. The challenge for policy makers in Thailand is then to find the right balance between the various criteria. The trade-off a country like Thailand makes between e.g. efficiency and equity criteria can have important implications, e.g. adopting severity of disease rather than cost-effectiveness as guiding principle in the selection of HIV/AIDS interventions – and thus choosing treatment rather than prevention-centered strategies – could lead to a large number of extra infections in Thailand [14].

However, as of yet, there is no evidence on the criteria that should guide the priority setting of HIV/AIDS programmes in Thailand, including their relative importance. Also, it is not clear whether different stakeholders share similar preferences. It is against this background that this paper elicits preferences on the relative importance of criteria for priority setting of HIV/AIDS programmes in Thailand from policy makers, PLWHA and community members. The study uses discrete choice experiments (DCE) to elicit explicit preferences in HIV/AIDS area, and is the first study to do so in this area. The technique allows the assessment of the relative importance of different criteria that influence choice, in this case the priority setting of health interventions in HIV/AIDS control. The technique has shown promising results in a number of other

disease areas in low-income settings [23-25]. The present study can hence be interpreted as exploratory, to test the feasibility of the approach, and have a first impression of its findings.

Methods

Discrete choice experiments

Discrete choice experiments are a quantitative methodology for evaluating the relative importance of the different product attributes that influence consumer choice behavior [26]. In such experiments, respondents are asked to make choices between hypothetical alternative goods or services.

We employed DCE to determine the relative importance of criteria for priority setting, according to various stakeholders. In a DCE, respondents choose their preferred option from sets of hypothetical scenarios, each consisting of a bundle of criteria that describe the scenario in question. The criteria are constant in each scenario, but the levels that describe each criterion may vary across scenarios. Analysis of the options chosen by respondents in each scenario reveals the extent to which each criterion is important to the decision at hand [27, 28]. Running a DCE involves selection of participants, identification of criteria through group discussion, DCE design and administration of the DCE survey. These are discussed in turn.

Participants

In this study, we chose to explore the views of policy makers in comparison with two other groups of stakeholders, i.e. PLWHA, and community members represented by village health volunteers (VHVs).

The policy makers were represented by 28 national – and province level decision makers strongly involved in health resource allocation decisions in Thailand specifically on HIV/AIDS. As a first step in the

selection process, members of the National AIDS Committee were asked to participate. As a second step, they were asked to nominate other decision-makers meeting the above criterion. A total of 30 decision makers were invited, and 28 agreed to participate in the study. They were predominantly male (71.4%), and all being higher educated (bachelor degree or more) (Table 1).

Table 1 General characteristics of respondents

	Perspective		
	Policy makers (n = 28)	People living with HIV/AIDS (n =74)	Village Health Volunteers (n = 50)
Age (years)			
mean (SD)	47.4 (6.9)	33.1 (5.5)	47.6 (9.0)
Gender			
male	20 (71.4%)	28 (38.9%)	6 (12.0%)
female	8 (28.6%)	44 (61.1%)	44 (88.0%)
missing	-	2	-
Education			
lower than bachelor	-	44 (61.1%)	40 (80.0%)
bachelor degree	4 (14.8%)	27 (37.5%)	10 (20.0%)
master degree	16 (59.3%)	1 (1.4%)	-
doctoral degree	7 (25.9%)	-	-
missing	1	2	-
Occupation			
government officer	27 (100.0%)	1 (1.4%)	4 (8.0%)
private company employee	-	4 (5.6%)	3 (6.0%)
agriculturists	-	5 (7.0%)	2 (4.0%)
housewives	-	-	30 (60.0%)
freelancers/self-employee	-	54 (76%)	3 (6.0%)
others	-	7 (9.8%)	8 (16.0%)
missing	1	3	-

The PLWHA were all members of the Thai network for people living with HIV/AIDS, representing PLWHA groups at the province and regional level in Thailand. In a regular network-meeting, we invited the members to participate in the present study. In total, 74 out of 85 invited PLWHA agreed to participate. They were predominantly female (61%) with a minority being higher educated.

The community members were represented by VHVs – these are community members who have been trained by public health providers

in order to provide basic health care delivery including first aid and necessary health information to members of the village they reside in. In the selection process, we invited 100 VHVs in a semi-urban district of Samutprakan province, and out of these, 50 agreed to participate. They were predominantly female (80%), with a minority being higher educated.

Table 2 Attributes and levels

Attributes	Levels	Level coding	Definition
Target group	Children (Child)	Child	0 - 12 years old
	Teenagers	Teen	13 - 20 years old
	High risk adults	HiRisk	≥ 21 years old with high risk behavior e.g. sex workers, men who have sex with men, injected drug users, pregnant women, etc.
	All adults	Adults	≥ 21 years old without any specification
Gender of target group	Male	Male	aiming to male population
	Female	Female	aiming to female population
	Both genders	BothGen	not specify gender of target group
Type of intervention	Treatment and care of patients with HIV (not AIDS)	HIV	aiming to treat HIV infected people (CD4 ≥ 200) and reduce HIV transmission
	Treatment and care of patients with AIDS	AIDS	aiming to treat AIDS patients (CD4 < 200)
	Preventing HIV	Prevent	aiming to prevent general publics from HIV infection
Effectiveness	Low effective	LoEff	less than 50% of participants benefit
	High effective	HiEff	more than 50% of participants benefit
Quality of evidence on effectiveness	Weak evidence	Weak	no evidence but observation and/or expert opinions
	Strong evidence	Strong	evidence from domestic and/or international literatures

Identification of criteria and criteria levels

To define the criteria in DCE, group discussions were organized with each group of stakeholders including six representatives of that group. As an initial step, two HIV/AIDS interventions were presented. Then participants were asked to decide which intervention should be funded and reasons for the choices were discussed. The discussion was then broadened to discuss general reasons, or criteria, to fund HIV/AIDS interventions, and finally agreement was reached on a comprehensive set of criteria. Resulting criteria and associated levels from the three group discussions were compared. The final selection

of criteria and levels included those that were identified by two or more discussion groups. This resulted in identification of one criterion at four levels, two criteria at three levels, and two criteria at two levels (Table 2).

DCE design

The DCE was designed on the following principles. To avoid information overload from a full factorial of 144 possible scenarios based on identified criteria and levels ($4^1 \times 3^2 \times 2^2$), a limited number is chosen on the basis of a fractional experimental designs catalogue produced by Hahn and Shapiro [29]. The catalogue includes a number of orthogonal designs, both full factorial and fractional factorial ones, with differing numbers of attributes at differing numbers of levels. The fractional factorial design – fitting the number of identified criteria and levels – included a subset of 16 scenarios (representing an orthogonal array and minimizing multicollinearity), to allow the estimation of all main effects. Each of these 16 scenarios was paired by fold-over technique. A two-scenario with non-labeled experimental design was employed for each choice set. The plausibility of each scenario was evaluated with experts, policy makers, and in a pilot study with VHVs. An example of scenario for this DCE is presented in Table 3.

DCE survey

The DCE survey was administrated to policy makers through face-to-face interview and to the other groups by self-administered questionnaires. For the latter groups, group meetings were organized to clarify the aims of the DCE survey and the questionnaire. At completion of the questionnaire, participants were asked to simply rank order the criteria included in the DCE on the basis of their importance in priority setting of HIV/AIDS interventions. To standardize and maintain quality of the data collection, the group discussion and interviews were conducted only by the first author.

Table 3 Example of DCE question and explanatory note

Imagine that you were a Thai health policy maker faced with priority setting decisions on how to allocate scarce budgets. Given that only one of the two options below can receive funding, which one would you choose?

Choice set 1	A	B
Target group	high risk adults	all adults
Gender of target group	both genders	female
Type of intervention	preventing HIV	treatment & care of patients with HIV
Effectiveness	low effective	high effective
Quality of evidence on effectiveness	strong evidence	weak evidence
Which one would you choose? Please tick a box	☐	☐

Explanatory note

Option A An intervention aims to prevent people who are ≥21 years of age with high risk behavior e.g. female sex workers, injecting drug users, and gay men from HIV infection. There is evidence from domestic or international literature presenting that less than 50% of participants in this intervention can protect themselves from HIV infection.

Option B An intervention aims to treat HIV infected female who are ≥21 years of age. There is no evidence to support the effectiveness of this intervention; however, experts believe that more than 50% of participants can be treated or can reduce HIV transmission.

Data analysis

Regression coefficients, average marginal effects, and relative contributions were estimated from the response data by the statistical software program STATA 10.0. Regression coefficients indicate the sign of the effect of a variable on the probability of selection of an intervention. Since the response data is a dichotomous outcome – '1' is coded for being chosen, with '0' is coded for not being chosen – and dummy coding was used to transform the attribute levels into L-1 dummy variables in which each dummy is set equal to 1 when the qualitative level is present and set equal to 0 if it is not.

Binary logistic regression models were used to analyze the data, with the following description,

$$\begin{aligned} Logit(P) = {} & \beta_0 + \beta_{1\text{-}3}\, Target\ group + \beta_{4\text{-}5}\, Gender\ of\ target\ group + \\ & \beta_{6\text{-}7}\, Type\ of\ intervention + \beta_8\, Effectiveness + \\ & \beta_9\, Quality\ of\ evidence\ on\ effectiveness + \varepsilon \end{aligned} \qquad (1)$$

where P is the probability of an intervention being selected by the respondents, β_0 is the constant term, β_i (i=1-9) are the coefficients of the model indicating the probability of selection relative to the reference criterion level, and ε is the unobservable error term. To control for differences in attractiveness of DCE scenarios, dummies were added for scenarios to equation (1).

Marginal effects reflect the change in the probability of selection of an intervention. These were computed by taking the average difference in predicted probability of P with and without the variable, while holding the distribution of the other variables at their sample value, and then taking the sample mean of these differences.

The relative contributions were calculated to signify the contribution of one criterion to the variation in preferences explained by the regression model and therefore describe the relative importance of the various criteria in the choice of interventions. This relative importance depends on the variation in the levels that are chosen for each of the attributes. Variation explained by the model is based on Efron's R^2 [30],

$$R^2_{Efron} = 1 - \frac{\Sigma_i(y_i - \hat{\pi}_i)^2}{\Sigma_i(y_i - \bar{y}_i)^2} \qquad (2)$$

where y_i indicates the observed choice and $\hat{\pi}_i$ indicates the predicted probability that choice equal to 1. The relative contributions are calculated by computing Efron's R^2 of the above model minus Efron's R^2 of the model where the criterion is held constant at its sample mean. This procedure shows the contribution of criteria irrespective of the number of levels they have.

To test whether the decision makings on choice selections vary between perspectives, the likelihood ratio test was analyzed. At the end, as a validity check, the resulting rank ordering of attributes derived from DCE exercise was compared (presented by the relative contributions) to

those derived from a simple rank ordering.

Research ethics

This study was approved by Institute for the Development of Human Research Protections (IHRP), Ministry of Public Health, Thailand. All participants provided their written informed consent for the discussion and the interview.

Results

Table 4 shows the results of logistic regression analysis and marginal effects calculation from the DCE response data, for each group of stakeholders. First, policy makers expressed a preference for highly effective interventions compared to those with low effectiveness, as indicated by the marginal effects. These show that the former interventions have a 38.5% higher probability of being selected than the latter. The next important criterion is intervention type, and policy makers expressed a preference for preventive interventions, followed by treatment of and care for HIV-infected people, and treatment of and care for AIDS-patients. The marginal effects show that preventive interventions have a 33% higher probability to be selected than the latter. Next, policy makers expressed a preference for interventions with strong evidence on intervention effectiveness compared to weak evidence. Also, policy makers preferred interventions that target high risk groups, followed by teenagers, adults, and children. Policy makers revealed a weak preference for gender of target group, with a priority to target both genders, followed by males and then females.

Second, PLWHA had similar preferences as policy makers with some exceptions. Most notably, PLWHA expressed a strong preference for treatment or care for AIDS patients, and the probability of selection of these interventions is 24.5% higher than treatment and care for HIV-

infectious people. Moreover, they expressed a strong preference for targeting both genders rather than one gender only. Third, VHVs preferences cohered largely with that of policy makers.

The different models for policy makers, PLWHA and VHVs demonstrate a good fit as indicated by the pseudo R^2, and Hosmer-Lemeshow chi-square. The likelihood ratio test presents that the preferences on the criteria of each group of stakeholders are significantly different.

Table 4 Discrete choice model results and marginal effects by perspective

		Perspectives								
		Policy makers			People living with HIV/AIDS			Village Health Volunteers		
Criteria	Levels	Coefficient (95% CI)	(p-value)	Marginal effect	Coefficient (95% CI)	(p-value)	Marginal effect	Coefficient (95% CI)	(p-value)	Marginal effect
Target group	Child									
	Teen	1.049* (0.445, 1.654)	(0.001)	0.183	0.135 (-0.169, 0.440)	(0.385)	0.030	0.830* (0.464, 1.196)	(0.000)	0.181
	HiRrisk	1.153* (0.502, 1.803)	(0.001)	0.199	0.022 (-0.323, 0.368)	(0.900)	0.005	0.314 (-0.105, 0.734)	(0.142)	0.069
	Adults	0.023 (-0.470, 0.517)	(0.926)	0.004	-0.279 (-0.575, 0.017)	(0.065)	-0.061	-0.249 (-0.609, 0.112)	(0.176)	-0.054
Gender of target group	Male									
	Female	-0.256 (-0.762, 0.250)	(0.321)	-0.043	0.082 (-0.184, 0.348)	(0.544)	0.018	0.196 (-0.123, 0.514)	(0.229)	0.043
	BothGen	0.266 (-0.131, 0.663)	(0.189)	0.045	1.132* (0.911, 1.354)	(0.000)	0.255	0.724* (0.458, 0.990)	(0.000)	0.161
Type of intervention	HIV									
	AIDS	-0.493* (-0.904, -0.081)	(0.019)	-0.088	1.091* (0.869, 1.313)	(0.000)	0.245	-0.476* (-0.744, -0.208)	(0.001)	-0.105
	Prevent	1.967* (1.450, 2.485)	(0.000)	0.333	0.212 (-0.052, 0.476)	(0.116)	0.047	0.246 (-0.078, 0.569)	(0.137)	0.054
Effectiveness	LoEff									
	HiEff	1.983* (1.643, 2.323)	(0.000)	0.385	0.627* (0.54, 0.800)	(0.000)	0.140	1.185* (0.973, 1.395)	(0.000)	0.275
Quality of evidence on effectiveness	Weak									
	Strong	1.310* (0.976, 1.645)	(0.000)	0.237	0.356* (0.183, 0.528)	(0.000)	0.079	0.349* (0.139, 0.560)	(0.001)	0.077
Log likelihood		-424.4532			-1434.3323			-963.3818		
Pseudo R^2		0.2747			0.0992			0.0984		
Hosmer-Lemeshow chi-square		1.36			2.79			1.87		
(p-value)		(0.995)			(0.947)			(0.985)		

*Significant variables ($p < 0.05$), Likelihood ratio test ($p<0.000$)

The contribution R^2 indicates the overall importance of criteria (Table 5). Policy makers considered intervention effectiveness as the most important criterion, followed by intervention type, quality of evidence, target group, and gender of target group. PLWHA considered gender of target group as most important criterion, followed by intervention type, intervention effectiveness, quality of evidence, and target group. VHVs considered intervention effectiveness as most important, followed by target group, gender of target group, type of intervention, and quality of evidence. Table 5 also shows the results of the simple rank ordering of criteria, and it reveals large overlaps for the policy makers, but less so for PLWHA and VHVs.

Table 5 Rank ordering of criteria in simple ranking and DCE exercise

	Perspective					
	Policy makers		People living with HIV/AIDS		Village Health Volunteers	
Simple ranking						
Rank 1	Effectiveness		Target group		Target group	
Rank 2	Target group		Effectiveness		Gender of target group	
Rank 3	Type of intervention		Quality of evidence		Type of intervention	
Rank 4	Quality of evidence		Type of intervention		Effectiveness	
Rank 5	Gender of target group		Gender of target group		Quality of evidence	
DCE		R^2		R^2		R^2
Rank 1	Effectiveness	0.152	Gender of target group	0.058	Effectiveness	0.075
Rank 2	Type of intervention	0.091	Type of intervention	0.042	Target group	0.017
Rank 3	Quality of evidence	0.053	Effectiveness	0.019	Gender of target group	0.016
Rank 4	Target group	0.015	Quality of evidence	0.008	Type of intervention	0.013
Rank 5	Gender of target group	0.014	Target group	0.003	Quality of evidence	0.006

DCE, discrete choice experiments; R^2, contribution R^2

Discussion

The study has identified criteria for priority setting of HIV/AIDS interventions in Thailand using perspective of policy makers, PLWHA, and VHVs, and revealed that different stakeholders have different preferences

vis-à-vis these criteria. A number of observations can be made.

First, the findings show that policy makers give priority to preventing HIV interventions, and targeting high risk populations. This is in line with the Thai national policy on priority setting of HIV interventions, which focuses on prevention among people who may be the most at risk of transmitting HIV [3]. Yet, although policy makers may put higher priority on HIV prevention programs, it is obvious that therapy cannot be neglected [3, 14, 19]. The Thai national HIV/AIDS plan emphasizes integrating HIV and AIDS prevention and treatment programs [3, 31]. The emphasis on intervention effectiveness and related quality of evidence confirms the importance that is attributed to evidence-based medicine in Thailand [8].

Secondly, the study reveals large similarities in the preferences for criteria for HIV/AIDS interventions between policy makers and VHVs. This may indicate that the preferences of community members (based on the sample used) are well reflected through decisions made by policy makers. This study also highlights the differences in preferences between PLWHA and the other stakeholder groups. The preferences of the former for care and treatment may reflect self-interests, whereas the preferences of the latter may reflect preferences for the society at large.

Thirdly, our findings show overlap between the ranking of criteria resulting from DCE and as obtained from simple ranking for policy makers, but less so for other stakeholders. This may indicate validity and hence usefulness of DCE for (well-educated) policy makers, but possibly less so for other (less-educated) stakeholders.

Recently, a number of empirical priority setting studies have included the views of different stakeholders, such as patients and community members, besides those of policy makers [32]. Inclusion of different perspectives is important, to enhance the legitimacy of the priority setting process, as has been acknowledged in the Accountability for

Reasonableness framework [33]. The present study is a first step to integrate different views, by documenting differences and similarities. The study did not aim to reach consensus by the different stakeholders, and it is not sure which methodology could be used to accommodate this. A challenge here is to avoid dominance by one group stakeholder (e.g. policy makers) over another (e.g. community members).

The DCE in this study only includes the criteria that were found to overlap from the focus group discussions. The rationale for doing so was to accommodate comparability of study findings (so to include identical criteria in DCE for the various stakeholders) on the one hand, while maintaining the number of criteria to a manageable number (thus not including all possible criteria that were put forward by any discussion group) on the other hand. However, this choice may have led to the omission of important criteria for some groups of stakeholders, and may have reduced the validity of study findings. Next studies should seek to strike a balance between comparability and validity.

Our study findings are based on small sample sizes (ranging from 28 for policy makers, to 74 for PLWHA), and should therefore be interpreted with caution. This also indicates the explorative character of our study. A proper sample size calculation is difficult in the absence a prior information on the variances on the responses - we based our sample sizes on previous similar studies, e.g. in Ghana [23] and Nepal [24] that also included a limited number of respondents.

Intervention utility can be calculated by assuming a main effects additive utility model on the basis of a linear combination of the weights of each level of all criteria [28]. This utility can then be compared to costs, to derivate a cost-utility estimate. Subsequently, interventions can then be rank ordered on the basis of these cost-utility estimates, and this rank ordering reflects the overall intervention attractiveness. A rank ordering of HIV/AIDS interventions on the basis of cost-utility information can be used to inform policy decision making,

and is topic for further research. This is conceptually more consistent approach than considering cost-effectiveness as a separate criterion, as applied in other similar studies [23, 25]. However, cost-effectiveness as a separate criterion also has much appeal to policy makers, and is not clear which approach is best in supporting decision in real-life.

The present study findings, and associated rank ordering of HIV/AIDS interventions, can be considered as general principles to prioritisation of HIV/AIDS interventions in Thailand. Since the DCE design only involves a set of criteria amendable to quantification, it ignores a range of non-quantifiable considerations – e.g. ethical, political, and social concerns [34, 35]. As such, any rank ordering of intervention can be indicative only, and should never be interpreted in a mathematical manner. In this respect, a broad clustering or typology of interventions that are probable 'good candidates for implementation', 'not good candidates for implementation', and 'in-between' is perhaps a good way to present results to policy makers. Such a broad typology is then a starting point for a more detailed priority setting process, in which policy makers can still deviate from the broad recommendations. A deliberative process is able to include the non-quantitative criteria and can encourage participatory approaches with a variety of stakeholders and interests [36, 37].

This exploratory study has shown the feasibility of eliciting explicit preferences on the criteria for prioritisation of HIV/AIDS interventions in Thailand. Further studies should refine methodological aspects, and interpret the findings in terms of the prioritisation of interventions.

Reference

1. United Nations Development Programme: **Thailand's response to HIV/AIDS: Progress and Challenges.** Bangkok: United Nations Development Programme; 2004.
2. UNAIDS/WHO working group on global HIV/AIDS and STI: **Epidemiological fact sheet on HIV and AIDS: Core data on epidemiology and response.** Geneva: World Health Organization; 2008.
3. The National Committee for HIV and AIDS Prevention and Alleviation: **The National Plan for Strategic and Integrated HIV and AIDS Prevention and Alleviation 2007 - 2011: Key contents.** The Agricultural Co-operative Federation of Thailand; 2007.
4. Phoolchareon W: **Evolution of Thailand's strategy to cope with the HIV/AIDS epidemic.** Food, Nutrition and Agriculture 2005, 34:16-23.
5. World Health Organization: **Scaling up antiretroviral treatment: Lessons learnt from Thailand.** New Delhi, India: World Health Organization, Regional Office for South-East Asia; 2007.
6. Tantivess S: **Universal access to antiretroviral therapy in Thailand: an analysis of the policy process.** University of London, 2006.
7. Baltussen R, Niessen L: **Priority setting of health interventions: the need for multi-criteria decision analysis.** Cost Effectiveness and Resource Allocation 2006, 14.
8. Pattanaphesaj J, Leartpitakpong C, Sirisamutr T, Teerawattananon Y: **Identifying information regarding effectiveness and cost-effectiveness of policy and strategies reorientation to mitigate the impact of HIV/AIDS in Thailand.** In Revitalizing HIV prevention and impact mitigation in Thailand. Nonthaburi: Health Intervention and Technology Assessment Program; 2009.
9. Teerawattananon Y, Hiransuthikul N, Hanvoravongchai P, Tantivess S, Lertpiriyasuwat C, Chaikledkaew U, Thavorncharoensap M, Youngkong S, Leelukkanaveera Y, Mohara A: **Effectiveness of routine offer of HIV counseling and testing at community hospitals in Thailand.** Nonthaburi: Health Intervention and Technology

Assessment Program; 2008.
10. Lertiendumrong J, Techakehakij W, Pongpirul K, Tangcharoensathien V, Srirattana S: **Using nucleic acid testing in screening donated blood in Thailand: a policy analysis.** Nonthaburi: International Health Policy Program; 2007.
11. Ono S, Kurotaki T, Nakasone T, Honda M, Boon-Long J, Sawanpanyalert P, Kimura K: **Cost-effectiveness analysis of antiretroviral drug treatment and HIV-1 vaccination in Thailand.** Japanese Journal of Infectious Disease 2006, 59:168-173.
12. Teerawattananon Y, Vos T, Tangcharoensathien V, Mugford M: **Cost-effectiveness of models for prevention of vertical HIV transmission – voluntary counseling and testing and choices of drug regimen.** Cost Effectiveness and Resource Allocation 2005, 3.
13. Whitehead M, Dahlgren G: **What can be done about inequalities in health?** The Lancet 1991, 338:1059 - 1063.
14. Tantivess S, Walt G: **Using cost-effectiveness analyses to inform policy: the case of antiretroviral therapy in Thailand.** Cost Effectiveness and Resource Allocation 2006, 4.
15. Kapiriri L, Norheim OF: **Criteria for priority-setting in health care in Uganda: exploration of stakeholders' values.** Bulletin of the World Health Organization 2004, 82:172-178.
16. Johnson-Masotti AP, Pinkerton SD, Holtgrave DR, Valdiserri RO, Willingham M: **Decision-making in HIV prevention community planning: an integrative review.** Journal of Community Health 2000, 25:95-111.
17. Baltussen R: **Priority setting of public spending in developing countries: do not try to do everything for everybody.** Health Policy 2006, 78:149-156.
18. Musgrove P, Fox-Rushby J: **Cost-effectiveness analysis for priority setting.** In Disease Control Priorities in Developing Countries. 2nd edition. Edited by Jamison D, Breman J, Measham A, Alleyne G, Claeson M, Evans D, Jha P, Mills A, Musgrove P. New York: Oxford University Press; 2006
19. Masaki E, Green R, Greig F, Walsh J, Potts M: **Cost-effectiveness**

of HIV interventions for resource scarce countries: setting priorities for HIV/AIDS. pp. 30. Berkeley: University of California; 2003:30.

20. Creese A, Floyd K, Guinness L: **Cost-effectiveness of HIV/AIDS interventions in Africa: a systematic review of the evidence.** The Lancet 2002, 359:1635-1642.
21. Brock D, Wikler D: **Ethical issues in resource allocation, research, and new products development.** In Disease Control Priorities in Developing Countries. 2nd edition. Edited by Jamison D, Breman J, Measham A, Alleyne G, Claeson M, Evans D, Jha P, Mills A, Musgrove P. New York: Oxford University Press; 2006
22. Teerawattananon Y, Russell S: **The greatest happiness of the greatest number? Policy actors' perspectives on the limits of economic evaluation as a tool for informing health care coverage decisions in Thailand.** BMC Health Service Research 2008, 8.
23. Baltussen R, Stolk E, Chisholm D, Aikins M: **Towards a multi-criteria approach for priority setting: an application to Ghana.** Health Economics 2006, 15:689-696.
24. Baltussen R, Asbroek At, Koolman X, Shrestha N, Bhattarai P, Niessen LW: **Priority setting using multiple criteria: should a lung health programme be implemented in Nepal?** Health Policy and Planning 2007, 22.
25. Jehu-Appiah C, Baltussen R, Acquah C, Aikins M, Amah S, Bosu WK, Koolman X, Lauer J, Osei D, Adjei S: **Balancing equity and efficiency in health priorities in Ghana: The use of multicriteria decision analysis.** Value in Health 2008, 11:1081 - 1087.
26. Louviere J, Hensher D, Swait J: Stated choice methods: analysis and applications. Cambridge: Cambridge University Press; 2000.
27. Ryan M, Gerard K: **Using discrete choice experiments to value health care programmes: current practice and future research reflection.** Applied Health Economics and Health Policy 2003, 2:55-64.
28. Kjær T: **A review of the discrete choice experiment – with emphasis on its application in health care.** pp. 143. Odense: University of Southern Denmark; 2005:143.

29. Hahn GJ, Shapiro SS: **A catalogue and computer program for the design and analysis of orthogonal symmetric and asymmetric fractional factorial experiments.** New York: General electric research and development centre; 1966.
30. Efron B: **Regression and anova with zero-one data: measures of residual variation.** Journal of the American Statistical Association 978, 73:113-121.
31. National AIDS Prevention and Alleviation Committee: **Ungass country progress report: Thailand (January 2006 - December 2007).** Nonthaburi: Ministry of Public Health; 2008.
32. Youngkong S, Kapiriri L, Baltussen R: **Setting priorities for health interventions in developing countries: a review of empirical studies.** Tropical Medicine and International Health 2009, 14:pp 1 - 10.
33. Martin DK, Giacomini M, Singer PA: **Fairness, accountability for reasonableness, and the views of priority setting decision-makers.** Health Policy 2002, 61:279-290.
34. Kingdon JW: United States; Policies and government; Political planning; Policy sciences. Boston: Brown; 1984.
35. Goddard M, Hauck K, Preker A, Smith PC: **Priority setting in health: a political economy perspective.** Health Economics, Policy and Law 2006, 1:79-90.
36. González-Pier E, Gutiérez-Delgado C, Stevens G, Barraza-Lloréns M, Porras-Condey R, Carvalho N, Loncich K, H DR, Kulkarni S, Casey A, et al: **Priority setting for health interventions in Mexico's system of social protection in health.** Lancet 2006, 368:1608-1618.
37. Bennett S, Chanfreau C: **Approaches to rationing antiretroviral treatment: ethical and equity implications.** Bulletin of the World Health Organization 2005, 83:541-547.

CHAPTER 5

Multi-criteria decision analysis for setting priorities on HIV/AIDS interventions in Thailand

Sitaporn Youngkong
Yot Teerawattananon
Sripen Tantivess
Rob Baltussen

Health Research Policy and Systems 2012; 10: 6.

Abstract

Introduction: A wide range of preventive, treatment, and care programmes for HIV/AIDS are currently available and some of them have been implemented in Thailand. Policy makers are now facing challenges on how the scarce resources for HIV/AIDS control can be spent more wisely. Although effectiveness and cost-effectiveness information is useful for guiding policy decisions, empirical evidence indicates the importance of other criteria, such as equity and the characteristics of the target population, also play important roles in priority setting. This study aims to experiment with the use of multi-criteria decision analysis (MCDA) to prioritise interventions in HIV/AIDS control in Thailand.

Methods: We used MCDA to rank order 40 HIV/AIDS interventions on the basis of priority setting criteria put forward by three groups of stakeholders including policy makers, people living with HIV/AIDs (PLWHA), and village health volunteers (VHVs). MCDA incorporated an explicit component of deliberation to let stakeholders reflect on the rank ordering, and adapt where necessary.

Results: Upon deliberation, policy makers expressed a preference for programmes that target high risk groups such as men who have sex with men, injecting drug users and female sex workers. The VHVs preferred interventions that target the youth or the general population, and gave lower priority to programmes that target high risk groups. PLWHA gave all interventions the same priority. The rank order correlation between the priorities as expressed before and after deliberation was 37% among the policy makers and 46% among the VHVs.

Conclusions: This study documented the feasibility of MCDA to prioritise HIV/AIDS interventions in Thailand, and has shown the usefulness of deliberative process as an integrated component of MCDA. MCDA holds potential to contribute to a more transparent and accountable priority setting process, and further application of this approach in the prioritisation of health interventions is warranted.

Keywords

Multi-criteria decision analysis, Priority setting, HIV/AIDS interventions, Discrete choice experiment

Introduction

Since HIV/AIDS has long been recognized as a leading cause of death and a high burden of disease in Thailand [1-3], a wide range of preventive, treatment and care programmes have been implemented to combat the disease. Recently, it was suggested that funding decisions on these programmes are not taken in a systematic manner and that the resulting mix of interventions is not offering the best value for money [4]. Consequently, Thai policy makers now face the challenge on how scarce resources available for HIV/AIDS control can be spent more wisely.

A range of studies are available to guide Thai policy makers to prioritise HIV/AIDS interventions. International estimates are available on the effectiveness and cost-effectiveness of HIV/AIDS interventions [5-7], and a recent document has systematically reviewed this information - in combination with national estimates - to provide informed priorities for HIV/AIDS control [4]. Yet the analysis falls short of including other criteria that may also play important roles in effective decision-making, such as ethical and social concerns. For example, the preference of society to pursue not only efficiency goals (that could result in prevention-oriented strategies for the general population) but also equity goals (that could, for example, result in treatment-oriented strategies for the severely ill) may have a large impact on the choice of programmes [8-10]. This indicates the need for multiple criteria decision analysis (MCDA) to account for other criteria beyond effectiveness and cost-effectiveness in decision-making process [11-14].

Although MCDA is used in only a few applications to guide the making of resource allocation decisions on health, it is routinely used in environmental, agricultural and marketing sciences to set intervention priorities [14]. In those disciplines, MCDA has evolved as a response to the observed inability of people to effectively analyse multiple streams of dissimilar information. The analysis establishes preferences between interventions by reference to an explicit set of criteria that the decision-making body has identified. A key component of every MCDA is the

performance matrix that describes the performance of the interventions against each criterion. The performance matrix may be the final product of the analysis, allowing the decision makers to qualitatively rank the interventions. Such intuitive processing of the data can be quick and effective, but it may also lead to the use of unjustified assumptions, causing an incorrect ranking of options. In analytically more sophisticated MCDA techniques, the information in the basic matrix is usually converted into consistent numerical values. The key idea is to construct scales representing preferences for the consequences, to weigh the scales for their relative importance, and then to calculate weighted averages across the preference scales [14]. In recent applications of MCDA [15-19], it has been criticised for its quantitative nature – studies typically rank ordered interventions on the basis of weighted averages, and in this way, consider quantifiable criteria only. To date, some attempts to capture non-quantifiable criteria to support the deliberative process have been reported [20,21]. This confirms that MCDA should rather include a deliberative process or other qualitative tools to also consider non-quantifiable concerns [20,22-25] and foster well-balanced judgments on intervention priorities [26,27].

The primary aim of this study is to experiment with the use of MCDA, including the use of deliberative process to prioritise interventions in HIV/AIDS control in Thailand. This research follows up on a recent study that employed discrete choice experiments (DCE) to identify and measure the relative importance of various quantifiable and non-quantifiable criteria for priority setting of HIV/AIDS interventions

Methods

The MCDA in the present study includes three components. Firstly, we assessed the performance of interventions on the criteria as identified in the DCE (i.e. we constructed the performance matrix). Second, we ranked ordered interventions. Third, we engaged with the various stakeholders

in a deliberative process to adapt the rank ordering where necessary. We also compared the rank order of interventions before and after the deliberative process. These components are discussed in turn.

Constructing the performance matrix

As a starting point, we identified a broad set of 40 HIV/AIDS interventions that are implemented, or eligible for implementation, in Thailand. We then constructed the performance matrix, i.e. we scored each of the selected HIV/AIDS interventions as a function of their performance on a set of criteria as identified in a recent DCE study [28]. This study identified the criteria to be relevant to the priority setting of HIV/AIDS control in Thailand through group discussions with each group of stakeholders including policy makers, people living with HIV/AIDS (PLWHA), and community members represented by village health volunteers (VHVs). The resulting criteria from the three group discussions were compared and finally those that were identified by two or more discussion groups were selected. These included: target groups of interventions (i.e. children, teenagers, adults, and high-risk adults); gender of target groups (i.e. female versus male); type of interventions (i.e. prevention, treatment of patients with HIV, and treatment of patients with AIDS); effectiveness (i.e. low versus high effectiveness); and quality of evidence (i.e. weak versus strong evidence). In the performance matrix, '0' denotes the absence and '1' indicates the presence of a criterion level (see Appendix 1). Information on target group, gender of target group and type of intervention was identified from each intervention itself, whereas the information on effectiveness of intervention and quality of evidence on effectiveness were based on the review conducted by Pattanaphesaj and Teerawattananon [4].

Rank ordering of interventions

Subsequently, we estimated the probability of selection of an intervention by using the logistic regression model derived from the DCE study [28]:

$$\begin{aligned} Logit(P) = ln\,[P/(1-P)] &= \beta_0 + \beta_{1\text{-}3}\,Target\ group + \beta_{4\text{-}5}\,Gender\ of\ target\ group \\ &+ \beta_{6\text{-}7}\,Type\ of\ intervention + \beta_8\,Effectiveness \\ &+ \beta_9\,Quality\ of\ evidence\ on\ effectiveness + \varepsilon \end{aligned}$$

where P is the probability of an intervention being selected by the respondents, β_0 is the constant term, β_i (i=1-9) are the coefficients of the model indicating the probability of selection relative to the reference criterion level, and ε is the unobservable error term. The regression coefficients for all criteria were obtained from each of the three groups of stakeholders – policy makers, PLWHA, and community members – representedby VHVs during the DCE survey (These are listed in Appendix 2). Next, all interventions were ranked in order of their probability of selection.

Deliberative process

In the deliberative process, group discussions were independently organised between July and August 2009 with three groups of stakeholders: six policy makers at the national level who are heavily involved in health resource allocation decisions in Thailand specifically on HIV/AIDS ('policy makers'); six members of the Thai network for PLWHA, representing PLWHA groups at the regional level in Thailand ('PLWHA'); and six community members who have been trained by public health providers to be the VHVs in Samutprakan province ('VHVs'). Participants were selected purposively from each group of stakeholders on the basis of their participation in the previous DCE study to ensure that they were familiar with the DCE and priority setting process. Each group discussion began with a brief introduction of the purpose of the meeting. Next, participants were presented with the rank ordering of the interventions, and they were then asked whether they agreed with the rank and to provide their justifications. We then asked them to re-classify all interventions into three categories – based on the traffic-light analogy: 'good candidates for implementation' (green), 'not good candidates for implementation' (red), and 'in-between' (yellow). This re-classification was done through consensus or, when necessary, through voting. In all steps, participants were encouraged by the researcher (SY) to discuss, bring in additional criteria, and share their opinions with justifications regarding their preferences.

Comparison of rankings

We compared the rank ordering of interventions before and after the deliberative process to explore the impact of deliberation by estimating the Spearman's rank correlation coefficient.

Research ethics

This study was approved by the Institute for the Development of Human Research Protections, Ministry of Public Health, Thailand. All participants provided their written informed consent.

Results

The rank ordering of the 40 HIV/AIDS interventions before and upon deliberation is presented in Table 1. As indicated by the ranking results before deliberation, the group of policy makers expressed a preference for preventive programs that are highly effective and target high risk groups such as men who have sex with men (MSM), injecting drug users (IDU), female sex workers (FSW), and HIV sero-discordant couples, with good quality of evidence on intervention effectiveness. The five interventions with the highest priority were voluntary counseling and testing (VCT) for IDU, street outreach for IDU, substitution treatment for IDU, improved sexual transmitted infection (STI) treatment services for IDU, and improved STI treatment services for HIV sero-discordant couples.

Upon deliberation, the group of policy makers reinforced their preference for highly effective programmes that target high risk groups. Community -based education and programmes that target the youth or the general population (with the exception for those aimed at the improvement of STI treatment services) were not preferred. In the deliberative process, a number of additional criteria were put forward in addition to those identified in the DCE. The policy makers group proposed cost-effectiveness as an important additional criterion. This group

also added the criteria of whether an intervention could be used for multiple purposes, and of safety. For example, a policy maker argued that introducing nucleic acid test screening for blood testing enables the Thai Red Cross Society to simultaneously investigate the existence of Hepatitis B and C with detecting HIV in the same specimen, thus creating added value. Also, a reliable blood donation system is very important to secure safety in Thailand in this respect. The other criterion mentioned was the importance of targeting health care workers at risk as a way of encouraging them to work with PLWHA in hospitals. This led to a change from the rank 10th of the post-exposure prophylaxis for health care workers before deliberation to 'good candidate for implementation' category, upon deliberation.

The group of PLWHA expressed a strong preference for treatment or care for AIDS patients i.e. highly active antiretroviral therapy, and treatment for opportunistic infection and other palliative care, as elicited by the DCE study (Table 1). However, upon deliberation, PLWHA gave almost all of the 40 interventions the same priority. They argued that every intervention was important and should be implemented together to prevent HIV infection. This group of PLWHA also asked that more budget possibilities be found from several sources of funding to secure the programmes and that otherwise, HIV/AIDS programmes should be smaller in scope so policy makers can cover all programmes within limited budgets.

Table 1 The HIV/AIDS interventions' ranking based on DCE, and the ranking after group discussions

HIV/AIDS intervention (target group)	Ranking											
	Policy makers				PLWHA				VHVs			
	DCE*			Group discussion	DCE			Group discussion	DCE			Group discussion
	Probability of selection (%)	(95% CI)	Rank**		Probability of selection (%)	(95% CI)	Rank		Probability of selection (%)	(95% CI)	Rank	
Community based education (MSM)	98.82	(94.9-99.7)	11	3	64.34	(45.2-79.8)	15	1	71.28	(48.9-86.6)	15	3
Community based education (IDU)	96.73	(86.1-99.3)	14	3	79.67	(63.1-90.0)	11	1	78.31	(56.8-90.8)	13	3
Community based education (Youth)	99.86	(98.8-100)	2	3	92.14	(79.0-97.3)	2	1	96.56	(87.6-99.1)	1	1
Community based education (FSW)	99.79	(97.8-100)	4	3	78.57	(51.9-92.6)	12	1	90.81	(69.1-97.8)	5	3
Workplace based education ± condom distribution/free STI clinic (FSW)	99.22	(94.4-99.9)	8	1	71.97	(47.4-88.0)	14	1	87.45	(66.1-96.1)	9	2
Workplace based education ± condom distribution/free STI clinic (general public)	98.58	(92.4-99.7)	12	3	84.45	(67.7-93.4)	9	1	87.06	(67.8-95.5)	10	2
Workplace based education ± condom distribution/free STI clinic (male conscripts in military camps)	99.84	(99.0-100)	3	2	77.15	(56.5-90.0)	13	1	89.03	(71.7-96.3)	8	2
School-based sex education programmes (+ life skills)	99.49	(96.8-99.9)	7	1	89.15	(75.8-95.6)	4	1	95.19	(86.0-98.4)	2	1
Peer education (MSM)	98.82	(94.9-99.7)	11	1	64.34	(45.2-79.8)	15	1	71.28	(48.9-86.6)	15	2
Peer education (IDU)	99.10	(94.3-99.9)	9	1	84.84	(67.2-93.9)	8	1	83.66	(60.2-94.5)	11	3
Peer education (Youth)	99.00	(93.9-99.8)	10	3	86.24	(70.5-94.3)	7	1	89.56	(72.8-96.5)	7	1
Peer education (FSW)	99.79	(97.8-100)	4	1	78.57	(51.9-92.6)	12	1	90.81	(69.1-97.8)	5	3
Mass media campaign (general public)	98.58	(92.4-99.7)	12	3	84.45	(67.7-93.4)	9	1	87.06	(67.8-95.5)	10	1
VCT ± STI clinic/ Condom distribution (Prison inmate)	99.54	(97.0-99.9)	6	1	88.01	(72.9-95.2)	6	1	92.19	(77.7-97.6)	4	2
VCT ± STI clinic/ Condom distribution (MSM)	99.84	(99.0-100)	3	1	77.15	(56.5-89.8)	13	1	89.03	(71.7-96.3)	8	3
VCT ± STI clinic/ Condom distribution (IDU)	99.87	(98.8-100)	1	1	91.29	(76.4-97.1)	3	1	94.36	(80.0-98.6)	3	1
VCT ± STI clinic/ Condom distribution (HIV sero-discordant couples)	99.54	(97.0-99.9)	6	1	88.01	(72.9-95.2)	6	1	92.19	(77.7-97.6)	4	2
VCT ± STI clinic/ Condom distribution (Youth)	99.49	(96.8-99.9)	7	2	89.15	(75.8-95.6)	4	1	95.19	(86.0-98.4)	2	1
VCT ± STI clinic/ Condom distribution (FSW)	99.22	(94.4-99.9)	8	1	71.97	(47.3-88.0)	14	1	87.45	(66.1-96.1)	9	3
VCT ± STI clinic/ Condom distribution (general public)	99.61	(97.0-100)	5	2	88.57	(71.5-96.0)	5	1	90.51	(70.7-97.4)	6	2
Routine (provider-initiated) voluntary HIV screening at healthcare settings (general public)	99.61	(97.0-100)	5	2	88.57	(71.5-96.0)	5	1	90.51	(70.7-97.4)	6	1
Condom use (availability and accessibility) (FSW)	99.79	(97.8-100)	4	1	78.57	(51.9-92.6)	12	1	90.81	(69.1-97.8)	5	2
Condom use (availability and accessibility) (general public)	98.58	(92.4-99.7)	12	3	84.45	(67.7-93.4)	9	1	87.06	(67.8-95.5)	10	1
Condom use (availability and accessibility) (HIV sero-discordant couples)	99.54	(97.0-99.9)	6	1	88.01	(72.9-95.2)	6	1	92.19	(77.7-97.6)	4	1
Condom use (availability and accessibility) (MSM)	99.84	(99.0-100)	3	1	77.15	(56.5-89.8)	13	1	89.03	(71.7-96.3)	8	2
Street outreach (IDU)	99.87	(98.8-100)	1	1	91.29	(76.4-97.1)	3	1	94.36	(80.0-98.6)	3	1
Substitution treatment (IDU)	99.87	(98.8-100)	1	1	91.29	(76.4-97.1)	3	1	94.36	(80.0-98.6)	3	3
Using nucleic acid test screening (NAT) of voluntary blood donations (general public)	98.58	(92.4-99.7)	12	1	84.45	(67.7-93.4)	9	2	87.06	(67.8-95.5)	10	3
Screening blood products and donated organs for HIV (general public)	98.58	(92.4-99.7)	12	1	84.45	(67.7-93.4)	9	1	87.06	(67.8-95.5)	10	2
Improved STI treatment services (MSM)	99.84	(99.0-100)	3	1	77.15	(56.5-89.8)	13	2	89.03	(71.7-96.3)	8	2
Improved STI treatment services (IDU)	99.87	(98.8-100)	1	1	91.29	(76.4-97.1)	3	2	94.36	(80.0-98.6)	3	1
Improved STI treatment services (HIV sero-discordant couples)	99.87	(98.8-100)	1	1	91.29	(76.4-97.1)	3	2	94.36	(80.0-98.6)	3	2
Improved STI treatment services (Youth)	99.86	(98.8-100)	2	1	92.14	(79.0-97.3)	2	2	96.56	(87.6-99.1)	1	1
Improved STI treatment services (FSW)	99.79	(97.8-100)	4	1	78.57	(51.9-92.6)	12	2	90.81	(69.1-97.8)	5	2
Improved STI treatment services (general public)	99.61	(97.0-100)	5	1	88.57	(71.5-96.0)	5	2	90.51	(70.7-97.4)	6	2
Prevention mother to child transmission	99.79	(97.8-100)	4	1	78.57	(51.9-92.6)	12	1	90.81	(69.1-97.8)	5	2
PEP for healthcare workers	97.25	(86.1-99.5)	13	1	80.55	(61.5-91.5)	10	1	74.46	(47.8-90.3)	14	3
Increase alcohol tax	98.58	(92.4-99.7)	12	3	84.45	(67.7-93.4)	9	3	87.06	(67.8-95.5)	10	3
Highly active antiretroviral therapy for HIV/AIDS	95.64	(89.0-99.8)	15	1	94.92	(89.0-98.7)	1	1	82.24	(55.4-94.5)	12	2
Definitive treatment and care for opportunistic infections, and other palliative care	95.64	(89.0-99.8)	15	1	94.92	(89.0-98.7)	1	1	82.24	(55.4-94.5)	12	2

DCE, discrete choice experiment; PLWHA, people living with HIV/AIDS; VHVs, village health volunteers; MSM, men who have sex with men; IDU, injectable drug users; FSW, female sex workers; STI, sexual transmitted infection; VCT, voluntary counseling and testing; PEP, post-exposure prophylaxis

Rank 1 is for the interventions in a group of the highest probability of selection comparing to others on the list.

*The rankings from DCE depend on each group of stakeholders that unable to compare cross the groups.

**The rankings from group discussion of each group of stakeholders categorized into three groups through consensus; rank 1 is the intervention that was probable 'good candidate for implementation'; rank 2 is the intervention that was probable 'in between'; and rank 3 is the intervention that was probable 'not good candidate for implementation'.

PLWHA suggested the availability of alternatives as an additional criterion. For example, improving STI treatment services was not seen as a priority as alternative services were available in hospitals. PLWHA strongly disagreed with considering cost-effectiveness as a criterion – they argued that if an intervention is effective, it should be implemented, and that financial considerations should not be important. PLWHA also prioritised interventions that target the general population rather than high risk groups, because interventions for the general population cover a larger segment of the population, and reflect their notion that everyone has equal risk of HIV infection. One participant argued: "If these (interventions) are the national policy, they should be implemented to everyone not only the high risk groups. This is because everyone is at equal risk of HIV infection. We are all the same".

The preferences of VHVs cohered largely with those of policy makers except for the target group of the interventions: VHVs preferred interventions that target the youth rather than high risk populations. Consequently, community-based education and improvement of STI treatment services for the youth were the highest priority (Table 1). This preference was also confirmed upon deliberation. VHVs introduced the number of beneficiaries as an additional criterion. One volunteer mentioned: "Mass media campaigns have an impact on lots of people in the society. So we think this intervention is beneficial for the society at large". Furthermore, VHVs emphasised the need to adapt certain interventions to suit the groups targeted.

There was a significant correlation between the rank ordering before and after deliberation for policy makers (correlation coefficient 37%) and VHVs (46%). The correlation coefficient presents the consistency of results between the DCE ranking and deliberation ranking. No such significant correlation was found for the PLWHA. In addition, from the group discussions, we found that both policy makers and VHVs were generally positive about the ease of interpreting DCE results and the MCDA process, whereas PLWHA were generally negative because of the difficulty of the DCE questionnaire, which might lead

to a misunderstanding of the exercise among the respondents.

Discussion

This study has experimented with the use of MCDA to guide priority setting of HIV/AIDS interventions in Thailand, on the basis of consultations with the relevant stakeholders, through a deliberative process.

This study revealed the important of five criteria included in the DCE (i.e. target groups of interventions, gender of target groups, type of interventions, effectiveness, and quality of evidence on effectiveness), and a number of additional criteria raised during the deliberative process (i.e. ethical and social concerns, cost-effectiveness, (non) availability of alternatives, number of beneficiaries, and inappropriateuse or abuse of interventions). This reflects that stakeholders consider multiple criteria in prioritising interventions.

The abovementioned results highlight that MCDA has good potential to be used for the making of explicit prioritisation decisions. Also, we observed that the group of policy makers and VHVs - although not PLWHA respondents - applauded the systematic approach for priority setting, including the development of relevant criteria, the presentation of the performance of interventions against these criteria, and the deliberative process. Although MCDA seems difficult for PLWHA as they may not be familiar or comfortable to make trade-off decisions, the considerable overlap of the rank ordering before and upon deliberation in the group of policy makers and VHVs indicates that the quantifiable criteria used in the DCE partly reflect the concerns that stakeholders have in their intervention priorities. We believe that, through its explicit approach, MCDA contributes to the transparency and accountability of the priority setting process. Moreover, the provision of the DCE ranking reduces the stream of information that stakeholders

need to absorb when prioritising many interventions simultaneously. We therefore advocate that the identification and weighing of quantifiable criteria (whether through DCE or any other technique) should also be considered as an integrated MCDA component.

The present application of MCDA seems especially useful for policy planning in the long run as it can set priorities among a large set of interventions without defining the allocation of resources in a precise fashion. This use, also labeled *generalised priority setting*, can have far-reaching and constructive influences on policy formulation in the long term [26]. In contrast, the use of MCDA as presented in this study may not be useful for guiding highly contextualised decisions on the implementation of a single intervention, since this requires a higher level of detail in terms of financial and budgeting considerations.

This study has experimented with the inclusion of a process of deliberation in MCDA in a research environment. As of now, Thailand is stepping towards a routine application of MCDA to define its universal coverage benefit package. Observations of that process reveal that the inclusion of all relevant stakeholders right from the beginning of the MCDA process is imperative to its success [29].

Yet, we also observed a number of shortcomings in the use of MCDA in this study. First, DCE are cognitive demanding and may not be appropriate for all stakeholders. Most notably, PLWHA had difficulties in completing the DCE survey and interpreting the DCE findings. Further research is needed on the use of less cognitive demanding techniques than DCE that serve the same goal [30]. Second, our intervention set was relatively homogeneous in terms of the criteria covered in the DCE (e.g. effectiveness; quality of evidence on effectiveness; type of intervention), and this resulted in low variation in probabilities of inclusion. The application of DCE across different health conditions [15-19] is, in that respect, more powerful. Third, we did not engage all stakeholders in a single deliberative process to arrive at a consensus on the rank ordering of interventions, an adaption which would

represent the final stage of a successful priority setting process. However, the findings in this study can serve as a reflection of other stakeholders' preferences for policy decision-making that may lead to greater acceptance of priority setting decisions. Moreover, this study can be considered a lesson learned process to other stakeholders, especially the general population who have never been involved in health policy decision-making, and can help them to understand how to set priorities for health interventions. In future priority setting research, it would therefore be valuable to incorporate these public perspectives.

Although the set of criteria for MCDA may vary by country and health system context, the approach is generalisable to other settings. Furthermore, the MCDA criteria may be different if priority setting is required across different health problems e.g. infectious diseases, cardiovascular conditions, and mental health problems. Therefore, further exploration is warranted.

Conclusion

This study has documented the feasibility of MCDA to prioritising HIV/AIDS interventions in Thailand, and has shown the usefulness of a deliberative process as an integrated component of MCDA. MCDA holds potential to contribute to a more transparent and accountable priority setting process, and further application of this approach in the prioritisation of health interventions is warranted.

References

1. UNAIDS/WHO working on global HIV/AIDS and STI: Epidemiological fact sheet on HIV and AIDS: Core data on epidemiology and response. Geneva: World Health Organization; 2008.
2. Porapakkham Y, Rao C, Pattaraarchachai J, Polprasert W, Vos T, Adair T, Lopez AD: **Estimated causes of death in Thailand, 2005: implications for health policy.** Population Health Metrics 2010, 8: 14.
3. Tantivess S: Universal access to antiretroviral therapy in Thailand: an analysis of the policy process. University of London: PhD thesis; 2006.
4. Pattanaphesaj J, Teerawattananon Y: **Reviewing the evidence on effectiveness and cost-effectiveness of HIV prevention strategies in Thailand.** BMC Public Health 2010, 10: 401.
5. Hogan DR, Baltussen R, Hayashi C, Lauer J, Salomon JA: **Cost effectiveness analysis of strategies to combat HIV/AIDS in developing countries.** BMJ 2005, 331(7530): 1431-1437.
6. Creese A, Floyd K, Alban A, Guinness L: **Cost-effectiveness of HIV/AIDS interventions in Africa: a systematic review of the evidence.** The Lancet 2002, 359: 1635-1642.
7. Cohen DA, Wu S-Y, Farley TA: **Cost-effectiveness allocation of government funds to prevent HIV infection.** Health Affairs 2005, 24: 915-926.
8. Kaplan EH, Merson MH: **Allocating HIV-prevention resources: Balancing efficiency and equity.** American Journal of Public Health 2002, 92(12): 1905-1907.
9. Kenny N, Joffres C: **An ethical analysis of international health priority-setting.** Health Care Analysis 2008, 16: 145-160.
10. Tantivess S, Walt G: **Using cost-effectiveness analyses to inform policy: the case of antiretroviral therapy in Thailand.** Cost Effectiveness and Resource Allocation 2006, 4: 21.
11. Musgrove P: **Public spending on health care: how are different criteria related?** Health Policy 1999, 47: 207-223.
12. Dolan P, Shaw R: **A note on the relative importance that people**

attach to different factors when setting priorities in health care. Health Expectation 2002, 6: 53-59.
13. **Multi-criteria analysis manual** [http://iatools.jrc.ec.europa.eu/public/IQTool/MCA/DTLR_MCA_manual.pdf]
14. Baltussen R, Niessen LW: **Priority setting of health interventions: the need for multi-critieria decision analysis.** Cost Effectiveness and Resource Allocation 2006, 4: 14.
15. Baltussen R, Stolk E, Chisholm D, Aikins M: **Towards a multi-criteria approach for priority setting: an application to Ghana.** Health Economics 2006, 15: 689-696.
16. Baltussen R, ten Asbroek A, Koolman X, Shrestha N, Bhattarai P, Niessen LW: **Priority setting using multiple criteria: should a lung health programme be implemented in Nepal?** Health Policy and Planning 2007, 22: 178-185.
17. Green C, Gerard K: **Exploring the social value of health-care interventions: a stated preference discrete choice experiment.** Health Economics 2009, 18: 951-976.
18. Jehu-Appiah C, Baltussen R, Acquah C, Aikins M, d'Almeida SA, Bosu WK, Koolman X, Lauer J, Osei D, Adjei S: **Balancing equity and efficiency in health priorities in Ghana: the use of multicriteria decision analysis.** Value in Health 2009, 11: 1081-1087.
19. Koopmanschap MA, Stolk EA, Koolman X: **Dear policy maker: Have you made up your mind? A discrete choice experiment among policy makers and other health professionals.** International Journal of Technology Assessment in Health Care 2010, 26(2): 198-204.
20. Goetghebeur MM, Wagner M, Khoury H, Rindress D, Grégoire J-P, Deal C: **Combining multicriteria decision analysis, ethics and health technology assessment: applying the EVIDEM decisionmking framework to growth hormone for Turner syndrome patients.** Cost Effectiveness and Resource Allocation 2010, 8:4.
21. Culyer AJ: **Equity of what in healthcare? Why the traditional answers don't help policy- and what to do in the future.** Healthcare Papers 2007, 8(Spec No): 12-26.

22. Brock D, Wikler D: **Ethical issues in resource allocation, research, and new products development.** In Disease control priorities in developing countries. 2nd edition. Edited by Jamison DT, Breman JG, Measham AR, Alleyne G, Claeson M, Evans DB, Jha P, Mills A, Musgrove P. New York: Oxford University Press and the World Bank; 2006.
23. Kenny N, Joffres C: **An ethical analysis of international health priority setting.** Health Care Analysis 2008, 16: 145-160.
24. Kapiriri L, Norheim OF, Martin DK: **Fairness and accountability for reasonableness. Do the views of priority setting decision makers differ across health systems and levels of decision making?** Social Science & Medicine 2009, 68: 766-773.
25. Berney L, Kelly M, Doyal L, Feder G, Griffiths C, Jones IR: **Ethical principles and the rationing of health care: a qualitative study in general practice.** British Journal of General Practice 2005, 55: 620-625.
26. Baltussen R, Youngkong S, Paolucci F, Niessen LW: **Multi-criteria decision analysis to prioritize health interventions: Capitalizing on first experiences.** Health Policy 2010, 96: 262-264.
27. Johri M, Norheim OF: **Can cost-effectiveness analysis integrate equity concerns? A systematic review of current approaches.** In Paper presented at ISPOR 12th Annual European Congress Paris; 2009.
28. Youngkong S, Baltussen R, Tantivess S, Koolman X, Teerawattananon Y: **Criteria for priority setting of HIV/AIDS interventions in Thailand: A discrete choice experiment.** BMC Health Service Research 2010, 10: 197.
29. The Intervention Health Policy Program, Health Intervention and Technology Assessment Program: Research for development of health benefit package under universal health care coverage scheme: Issue 1. Nonthaburi: Ministry of Public Health; 2011.
30. Dolan JG: **Multi-criteria clinical decision support: A primer on the use of multiple criteria decision making methods to promote evidence-based, patient-centered healthcare.** Patient 2010, 3(4): 229-248.

	Performance of HIV/AIDS interventions on each criterion†													
	Target group of intervention				Gender of target group			Type of intervention			Effectiveness		Quality of evidence on effectiveness	
Interventions	Children	Teenagers	High risk adults	All adults	Male	Female	Both genders	HIV	AIDS	Prevention	Low effective	High effective	weak quality of evidence	Strong quality of evidence
Community based education (MSM)	0	0	1	0	1	0	0	0	0	1	1	0	0	1
Community based education (IDU)	0	0	1	0	0	0	1	0	0	1	1	0	1	0
Community based education (Youth)	0	1	0	0	0	0	1	0	0	1	0	1	0	1
Community based education (FSW)	0	0	1	0	0	1	0	0	0	1	0	1	0	1
Workplace based education ± condom/free STI clinic (FSW)	0	0	1	0	0	1	0	0	0	1	0	1	1	0
Workplace based education ± condom/free STI clinic (general public)	0	0	0	1	0	0	1	0	0	1	0	1	1	0
Workplace based education ± condom/free STI clinic (male conscripts in military camps)	0	0	1	0	1	0	0	0	0	1	0	1	0	1
School-based sex education programmes (+ life skills) (Youth)	0	1	0	0	0	0	1	0	0	1	0	1	1	0
Peer education (MSM)	0	0	1	0	1	0	0	0	0	1	1	0	0	1
Peer education (IDU)	0	0	1	0	0	0	1	0	0	1	1	0	0	1
Peer education (Youth)	0	1	0	0	0	0	1	0	0	1	1	0	0	1
Peer education (FSW)	0	0	1	0	0	1	0	0	0	1	0	1	0	1
Mass media campaign (General Public)	0	0	0	1	0	0	1	0	0	1	0	1	1	0
VCT + STI clinic/condom distribution (Prison inmate)	0	0	1	0	0	0	1	0	0	1	0	1	1	0
VCT + STI clinic/condom distribution (HIV sero-discordant couples)	0	0	1	0	0	0	1	0	0	1	0	1	1	0
VCT + STI clinic/condom distribution (MSM)	0	0	1	0	1	0	0	0	0	1	0	1	0	1
VCT + STI clinic/condom distribution (IDU)	0	0	1	0	0	0	1	0	0	1	0	1	0	1
VCT + STI clinic/condom distribution (Youth)	0	1	0	0	0	0	1	0	0	1	0	1	1	0
VCT + STI clinic/condom distribution (FSW)	0	0	1	0	0	1	0	0	0	1	0	1	1	0
VCT + STI clinic/condom distribution (General Public)	0	0	0	1	0	0	1	0	0	1	0	1	0	1
Routine (provider-initiated) voluntary HIV screening at healthcare settings (General Public)	0	0	0	1	0	0	1	0	0	1	0	1	0	1
Condom use (availability and accessibility) (MSM)	0	0	1	0	1	0	0	0	0	1	0	1	0	1
Condom use (availability and accessibility) (FSW)	0	0	1	0	0	1	0	0	0	1	0	1	0	1
Condom use (availability and accessibility) (General Public)	0	0	0	1	0	0	1	0	0	1	0	1	1	0
Condom use (availability and accessibility) (HIV sero-discordant couples)	0	0	1	0	0	0	1	0	0	1	0	1	1	0
Street outreach (IDU)	0	0	1	0	0	0	1	0	0	1	0	1	0	1
Substitution treatment (IDU)						0	1			1	0			

Interventions	Performance of HIV/AIDS interventions on each criterion†													
	Target group of intervention				Gender of target group			Type of intervention			Effectiveness		Quality of evidence on effectiveness	
	Children	Teenagers	High risk adults	All adults	Male	Female	Both genders	HIV	AIDS	Prevention	Low effective	High effective	weak quality of evidence	Strong quality of evidence
Using nucleic acid test screening (NAT) of voluntary blood donations (General Public)	0	0	1	0	0	0	1	0	0	1	0	1	0	1
Screening blood products and donated organs for HIV (General Public)	0	0	0	1	0	0	1	0	0	1	0	1	1	0
Improved STI treatment servcies (MSM)	0	0	0	1	0	0	1	0	0	1	0	1	1	0
Improved STI treatment services (IDU)	0	0	1	0	1	0	0	0	0	1	0	1	0	1
Improved STI treatment services (HIV sero-discordant couples)	0	0	1	0	0	0	1	0	0	1	0	1	0	1
Improved STI treatment services (Youth)	0	0	1	0	0	0	1	0	0	1	0	1	0	1
Improved STI treatment services (FSW)	0	1	0	0	0	0	1	0	0	1	0	1	0	1
Improved STI treatment services (General Public)	0	0	1	0	0	1	0	0	0	1	0	1	0	1
Prevention mother to child transmission	0	0	0	1	0	0	1	0	0	1	0	1	0	1
PEP for healthcare workers	0	0	1	0	0	1	0	0	0	1	0	1	0	1
Increased alcohol tax	0	0	0	1	0	0	1	0	0	1	1	0	0	1
Highly active antiretroviral therapy for AIDS patients	0	0	0	1	0	0	1	0	0	1	0	1	1	0
Highly active antiretroviral therapy for HIV infection	0	0	0	1	0	0	1	0	1	0	0	1	0	1
Definitive treatment and care for opportunistic infections, and other palliative care	0	0	0	1	0	0	1	1	0	0	0	1	0	1
	0	0	1	0	0	0	1	0	1	0	0	1	0	1

DCE, discrete choice experiment; PLWHA, people living with HIV/AIDS; VHVs, village health volunteers; MSM, men who have sex with men; IDU, injectable drug users; FSW, female sex workers; STI, sexual transmitted infection; VCT, voluntary counseling and testing; PEP, post-exposure prophylaxis

† '0' denotes the absence, and '1' denotes the presence.

Appendix 2 Discrete choice model results by perspective†

		Perspectives					
		Policy makers		People living with HIV/AIDS		Village Health Volunteers	
Criteria	Levels	Coefficient (95% CI)	(p-value)	Coefficient (95% CI)	(p-value)	Coefficient (95% CI)	(p-value)
Target group	Child						
	Teen	1.049* (0.445, 1.654)	(0.001)	0.135 (-0.169, 0.440)	(0.385)	0.830* (0.464, 1.196)	(0.000)
	HiRrisk	1.153* (0.502, 1.803)	(0.001)	0.022 (-0.323, 0.368)	(0.900)	0.314 (-0.105, 0.734)	(0.142)
	Adults	0.023 (-0.470, 0.517)	(0.926)	-0.279 (-0.575, 0.017)	(0.065)	-0.249 (-0.609, 0.112)	(0.176)
Gender of target group	Male						
	Female	-0.256 (-0.762, 0.250)	(0.321)	0.082 (-0.184, 0.348)	(0.544)	0.196 (-0.123, 0.514)	(0.229)
	BothGen	0.266 (-0.131, 0.663)	(0.189)	1.132* (0.911, 1.354)	(0.000)	0.724* (0.458, 0.990)	(0.000)
Type of intervention	HIV						
	AIDS	-0.493* (-0.904, -0.081)	(0.019)	1.091* (0.869, 1.313)	(0.000)	-0.476* (-0.744, -0.208)	(0.001)
	Prevent	1.967* (1.450, 2.485)	(0.000)	0.212 (-0.052, 0.476)	(0.116)	0.246 (-0.078, 0.569)	(0.137)
Effectiveness	LoEff						
	HiEff	1.983* (1.643, 2.323)	(0.000)	0.627* (0.454, 0.800)	(0.000)	1.185* (0.973, 1.395)	(0.000)
Quality of evidence on effectiveness	Weak						
	Strong	1.310* (0.976, 1.645)	(0.000)	0.356* (0.183, 0.528)	(0.000)	0.349* (0.139, 0.560)	(0.001)
Log likelihood		-424.4532		-1434.3323		-963.3818	
Pseudo R^2		0.2747		0.0992		0.0984	
Hosmer-Leme-show chi-square		1.36		2.79		1.87	
(p-value)		(0.995)		(0.947)		(0.985)	

*Significant variables ($p < 0.05$)
†Source: Youngkong S, Baltussen R, Tantivess S, Koolman X, Teerawattananon Y: Criteria for priority setting of HIV/AIDS interventions in Thailand: A discrete choice experiment. BMC Health Service Research 2010, 10:197.

CHAPTER 6

Multi-criteria decision analysis for including health interventions in the universal health coverage benefit package in Thailand

Sitaporn Youngkong
Rob Baltussen
Sripen Tantivess
Adun Mohara
Yot Teerawattananon

Submitted

Abstract

Introduction: Considering rising health expenditure on the one hand, and increasing public expectations on the other hand, there is a need for explicit health care rationing to secure public acceptance of coverage decisions of health interventions. The National Health Security Office, the institute managing the Universal Coverage Scheme (UC) in Thailand, recently called for more rational, transparent and fair decisions on the public reimbursement of health interventions. This paper describes the application of multi-criteria decision analysis (MCDA) to guide the coverage decisions on including health interventions in the UC health benefit package, in the period 2009-2010.

Methods: We described the MCDA priority setting process through participatory observation, and evaluated the rational, transparency and fairness of priority setting process against the Accountability for Reasonableness framework.

Findings: The MCDA was applied in four steps: 1) 17 interventions were nominated for assessment; 2) nine interventions were selected for further quantitative assessment on the basis of the following criteria: size of population affected by disease; severity of disease; effectiveness of health intervention; variation in practice; economic impact on household expenditure; and equity and social implications; 3) these interventions were then assessed in terms of cost-effectiveness and budget impact; and 4) decision makers qualitatively appraised, deliberated, and reached consensus on which interventions should be adopted in the package.

Conclusion: This project was carried out in a real-world context and has considerably contributed to the rational, transparent, and fair priority setting process through application of MCDA. Although the present project has applied MCDA in the Thai context, MCDA is adaptable to other settings.

Introduction

High-cost health interventions including pharmaceuticals and medical technologies are increasingly becoming available in Thailand, increasing public and patient expectations. However, due to limited resources, the government cannot make all of those interventions available to the population and this makes the need for priority setting of interventions more and more explicit. In the past, decisions on the public reimbursement of interventions were typically ad-hoc and not transparent [1, 2]: e.g. certain interest groups (like politicians, health professionals or industry) could selectively advocate new interventions for public reimbursement. The decision-making processes often lack a systematic way without clear criteria for making coverage decisions. Decision makers in Thailand have recently acknowledged this inadequate process and called for more rational, transparent and fair decisions on the public reimbursement of interventions to improve population health in the country [3]. As a spring-off, the National Health Security Office (NHSO), the institute that manages the largest health plan in Thailand (Universal Coverage Scheme; UC), initiated a collaborative research and development project with two independent research institutes: the Health Intervention and Technology Assessment Program (HITAP), and International Health Policy Program (IHPP), in 2009. The aim of the project was to develop an optimal strategy for the development of the UC benefit package, i.e. to determine which interventions should be candidate for public reimbursement.

At the outset of the project, it was decided to use multi-criteria decision analysis (MCDA) as an overall methodological approach for its potential for rational and transparent priority setting [4, 5]. MCDA is defined as 'a set of methods and approaches to aid decision-making, where decisions are based on more than one criterion, which make explicit the impact of all the criteria applied and the relative importance attached to them' [5].

This paper describes the application of MCDA to support the coverage decisions on including health interventions in the Thai UC health

benefit package, in the period 2009-2010. We address the following research question 'Does the use of MCDA lead to (more) rational, transparent and fair decisions in the development of the UC benefit package in Thailand?' In the absence of clear standard on all aspects, we evaluate the present project against the accountability for reasonableness (A4R) framework [6, 7], that specifies conditions for fair decision-making. In doing so, the framework also considers the aspects of rational and transparent priority setting.

To our knowledge, this is the first time in a low- or middle-income country that MCDA is practically used including a deliberative process and multiple stakeholders' involvement to guide national-level priority setting in health care coverage decisions. The experience of Thailand, and therefore this paper, also holds relevance for other countries, as it may inform them on the options and limitations of MCDA for setting priorities in health.

Multi-criteria decision analysis

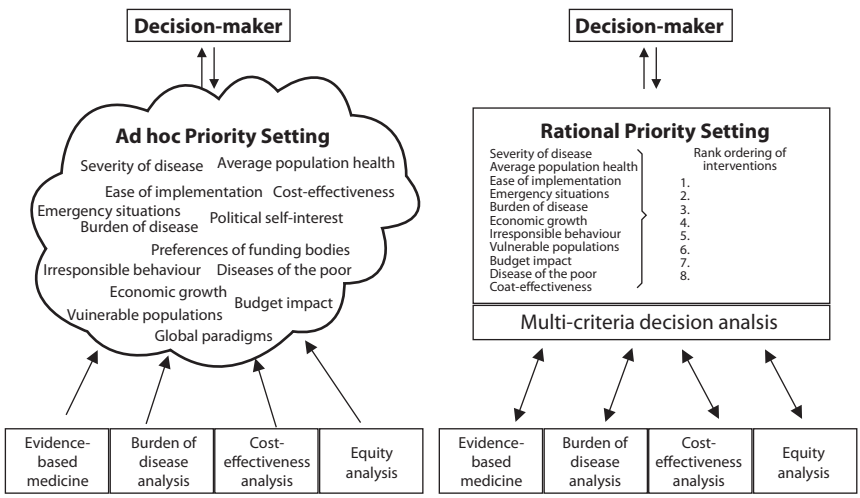


Figure 1 Ad hoc priority setting and rational priority setting

Source: Baltussen R, Niessen L (2006) Priority setting of health interventions: the need for multi-criteria decision analysis. Cost Effectiveness and Resource Allocation 4: 14.

Empirical evidence suggests that a number of criteria including efficiency, equity (e.g. giving priority to the severely ill or the poor), financial protection and political considerations are considered important by policy makers when setting priorities [8-10]. However, it is far from easy for policy makers to consider these criteria simultaneously - evidence on all criteria is not always available, criteria are not equally important and may even conflict with each other, and policy makers (as people in general) are not good at absorbing dissimilar types of information, and risk cognitive overload [4]. This has prompted the use of MCDA for priority setting (Figure 1) [4]. MCDA allows the identification of a comprehensive set of criteria, establishes the performance of interventions on those criteria in a so-called performance matrix, and then inspects the performance matrix qualitatively or quantitatively to rank order interventions [4]. In a qualitative inspection, policy makers simply interpret the performance matrix, and make implicit judgments on the weights of the various criteria. In a quantitative inspection, policy makers weigh the different criteria on the basis of its relative importance, and multiply the score by the weights to obtain weighed averages for all interventions. Interventions can subsequently be rank ordered according to these weighed averages.

Methods

We described the MCDA priority setting process through participatory observation. We evaluated the rational, transparency and fairness of priority setting process against the Accountabilty for Reasonableness (A4R) framework [6, 7]. The framework specifies the four conditions for fair decision-making. In doing so, the framework also considers the aspects of rational and transparent priority setting.

The whole process involved a project team (including NHSO, HITAP and IHPP) and a research team (including HITAP and IHPP). At the beginning of the project, the research team reviewed the international experience on the development of public health benefit packages to further refine and

operationalise the methodological approach. The review documented the experience of seven health technology assessment (HTA) organizations in Canada, England and Wales, the United States of America, the Netherlands, Germany, Sweden, and Spain, that all use an explicit process of priority setting (Table 1). The review concluded that all of these organizations consider multiple criteria, involve multiple stakeholders, and distinguish, in one way or another, four basic steps in their priority setting process. These steps were then also applied in the Thai setting and included: 1) nomination of interventions for assessment; 2) selection of interventions for assessment; 3) technology assessment of interventions; and 4) appraisal of interventions.

For steps 1 and 2, the project team established a consultation panel (panel 1) to reach consensus on who should be involved in these steps, and which criteria should be included as the selection criteria. Participants of the consultations were identified by their expertise and selected purposively to cover stakeholders who play an important role in the Thai health insurance system. The four steps are discussed in detail below.

Step 1: Nomination of interventions for assessment

The consultation panel 1 reached consensus to include large variety of stakeholders in Step 1 reasoning that coverage decisions also have broad consequences for the population of Thailand. Consequently, the NHSO established a working group including representatives of seven groups of: policy makers (i.e. decision makers at Ministry of Public Health and other 3 public health insurance schemes), health professionals (i.e. representatives from health professional associations), academics, patients, civil society (i.e. representatives from non-government organizations that are managed as permanent associations with legal status), industry (i.e. representatives from multi-international and local pharmaceutical companies, and medical devices industries), and lay people (i.e. citizen constituencies of the Thai National Health Assembly), but excluded international organizations and the researchers who conduct HTA as their interests may not reflect that of society. Each working group member was then assigned to propose a maximum of three interventions, including supportive information of the performance of these interventions on the established criteria. A total

of 17 interventions were nominated.

Step 2: Selection of interventions for assessment

As to the selection criteria, the research team - through its review - identified a range of criteria that are being used internationally (Table 1). The research team made sure all criteria were scientifically sound and relevant to the Thai context. This list of criteria was put forward to the consultation panel 1 as an input for discussion. The panel initially agreed with considering the criteria that were frequently used in the HTA organizations. Upon consultation with the panel 1, consensus was reached on the use of six criteria: i) size of population affected by the disease; ii) severity of disease; iii) effectiveness of health intervention; iv) variation in practice; v) economic impact on household expenditure; and vi) equity/ethical and social implications. Subsequently, the research team worked with a second consultation panel (panel 2) including policy makers and academics to further develop these criteria (i.e. establishing its definitions and measurement). The panel agreed to score the performance of each intervention on each criterion on an ordinal scale from 1 to 5. The panel decided to give all criteria equal weight, and that this could be changed in the future when necessary. The results of the panel discussions are presented in Table 2. The criteria are discussed in turn below.

- *Size of population affected by disease*. The size of the population affected by the disease holds a positive relationship with the impact of that disease for society, and is therefore an important criterion for priority setting, the panel argued. As indicator, the panel agreed to use the prevalence of the disease and scaled the prevalence on various levels.

- *Severity of disease*. Thai society generally gives high priority to interventions that target the severely ill because of their greater need for health care [11]. The panel defined the severity of disease on the basis of health state valuations with a range from 0 (worst health status) to 1 (best health status), and defined five levels. Following a Thai study that showed that some people

considered some health state worse than death [12], the panel agreed that the lowest scale could be less than 0.

- *Effectiveness of health interventions.* Effectiveness relates to the outcomes of interventions and is a routinely-used criterion in priority setting [13, 14]. Effectiveness is often expressed in quality-adjusted life years (QALYs) but the panel did not consider this suitable for this step because the effectiveness of interventions in terms of QALYs was not available for all interventions, and could not make available within the limited study period. Therefore, the panel created a separate scoring system for three categories of interventions: treatment/rehabilitation (giving higher priority to interventions that cure a disease than only improve quality of life); screening/diagnostic (giving higher priority to interventions with high accuracy (>60%) targeting a curable disease); preventive (given higher priority to interventions that can prevent more than 60% of a disease).

- *Variation in practice.* All Thai citizens are covered by a public health plan (the Civil Servant Medical Benefit Scheme for civil servants, state enterprise employees and their dependents; the Social Security Scheme for private sector employees; the UC for the rest of the population). Because these plans hold different agreements with health providers, there is growing concern about the inequity in health services delivered to beneficiaries of the different plans [15]. The panel acknowledged the differences in intervention coverage between the health plans, and across the country, and therefore the importance of this criterion. The panel developed different scales to reflect variation in practice, taking into account the source of evidence (local, national or international).

- *Economic impact of household expenditure.* One of the objectives of the UC is to protect household income from catastrophic health expenditure [16, 17[. The literature defines catastrophic expenditure as households' spending on direct health care costs (e.g. medicines) which exceeds 10% of household's expenditure [15, 18, 19]. The panel adopted this definition to establish the scoring scale of this criterion. The

Table 1 The results of the reviews regarding stakeholder involvement and criteria used

	The reviewed organizations						
	NICE	CADTH	VATAP	Health council of the NL	SBU	DAHTH	CAHTH
Stakeholder involvement in nomination step							
Policy makers	●	●	●		●	●	
Health professionals	●	●	●		●	●	●
Academics	●	●	●		●	●	●
Patients	●	●	●			●	●
Civil society	●					●	
Private sector	●				●	●	
General population	●					●	
International organizations			●				
The researchers who conduct HTA	●	●	●	●			
Stakeholder involvement in selection step							
Policy makers	●	●			●	●	
Health professionals	●	●	●		●	●	●
Academics	●	●			●	●	●
Patients	●					●	
Civil society	●					●	
Private sector						●	
General population	●	●					
International organizations							
The researchers who conduct HTA	●	●		●			
Criteria used in selection of health technology assessment topics							
Variation	●	●	●		●	●	●
Resource impact	●						
Necessity				●			
Effectiveness		●		●	●	●	●
Efficiency				●		●	
Cost of intervention			●		●		●
Individual responsibility				●			
Translating new knowledge into clinical practice or care			●		●		●
Possibility of change in cost							●
Burden/severity of disease	●		●			●	●
Need for knowledge of the problem			●				
Urgency/ timeliness	●						
Number of potential patients		●	●		●		●
Policy importance	●						
Equity/ ethical and social implications	●	●	●		●		●
Economic impact	●	●			●		●
Sufficient evidence for assessment			●			●	
Criteria used in health intervention assessment							
Effectiveness/ efficacy	●	●	●	●	●	●	●
Safety							●
Cost		●					
Cost-effectiveness	●	●		●	●	●	●
Budget impact		●					
Population impact		●					
Planning/ utilization/ legal issues		●				●	
Equity/ ethical and social implication		●			●	●	

NICE - the National Institute for Health and Clinical Excellence (England and Wales); CADTH - Canadian Agency for Drug and Technologies in Health (Canada); VATAP - Veteran Administration's Technology Assessment Program (the United States of America); SBU - Swedish Council on Technology Assessment in Health Care (Sweden); DAHTH - German Agency for Health Technology Assessment (Germany); CAHTH - Catalan Agency for Health Technology Assessment (Spain)

scale was established by dividing the 10% top rank of the average household expenditure on health care (baht per year) from a national household socio-economic survey in 2008 [20] into quintile groups, and then using the upper value of each expenditure interval for setting the scores.

- *Equity/ Ethical and social implication*. The panel considered ethical and social implications of interventions to be important, and argued that the poor and patients with rare diseases are - in a moral sense - more deserving of health care than others. The panel decided that priority should be given to diseases that are more frequent among the poor (based on World Health Report 2002 that classifies poverty as a risk factor of disease) [21]. In the absence of adequate definitions of 'rare diseases' in Thailand, the panel decided to use the lowest prevalence level of the criterion 'size of population affected by disease' (prevalence = 10,000) as a threshold.

As to the selection of interventions for assessment, the consultation panel (panel 1) determined to use the same working group as mentioned above but without the representatives of policy makers and industry (as they were considered to have a potential conflict of interest) and lay people (as they were considered difficult to identify, and to be adequately represented by the representatives from civil society), and this working group was established by the NHSO.

The research team reviewed the 17 nominated interventions against the six selection criteria, and then presented all information to the working group. Because of limited and incomparable information on severity of disease for the nominated interventions, the working group decided to omit this criterion. The performances of the 17 interventions on the five remaining criteria were summarized in a performance matrix (additional file 1). Upon inspection and deliberation, they selected nine interventions for further assessment. Of these interventions, eight were selected because they scored best in the overall ranking. One intervention 'absorbent products for urinary and fecal incontinence among disable and elderly people' was added

because the target group was considered to be vulnerable and deserving of publicly funded health care. The NHSO's Subcommittee for Development of Benefit Package and Service Delivery (SCBP), which includes multi-disciplinary stakeholders i.e. policy makers, health professionals, civil society, and patient groups, approved in May 2010 that these nine interventions would be subject of detailed assessment.

Table 2 Selection criteria

Criteria	Definition	Parameter	Scoring
1. Size of population affected by disease	Number of people affected by the disease or health problem that treated, or prevented by the proposed intervention among Thai population at a specified time.	Prevalence	5 = higher than 500,000 4 = 100,001 – 500,000 3 = 50,001 – 100,000 2 = 10,001 – 50,000 1 = less than 10,000
2. Severity of disease	Severity of disease or health problem that treated or prevented by the proposed intervention by considering its impact on the patients' quality of life	Quality of life score	5 = higher than 0.61 4 = 0.41 – 0.60 3 = 0.21 – 0.40 2 = 0.01 – 0.20 1 = less than 0
3. Effectiveness of health intervention	The final outcomes of the proposed intervention that benefit the patients with regard to objective of the intervention		
	3.1 For treatment/ rehabilitation: Capacity of the proposed intervention to treat or rehabilitate the patients from the disease and its impact on the patients' quality of life	The clinical benefit of the proposed intervention and improvement in quality of life	5 = cure 4 = prolong life & major improvement of QoL 3 = prolong life & minor improvement of QoL 2 = major improvement of QoL 1 = minor improvement of QoL
	3.2 For screening/ diagnostic: Quality of the proposed intervention to screen or diagnose the disease of the patients and the expected outcome beyond the screening or diagnostic	Accuracy of the intervention and whether the screened disease could be cured	5 = accuracy > 80% & screened disease could be cured 4 = accuracy 60 – 80% & screened disease could be cured 3 = accuracy > 80% but screened disease could not be cured 2 = accuracy 60 – 80% & screened disease could not be cured or accuracy < 60% & screened disease could be cured 1 = accuracy < 60% & screened disease could be cured

Table 2 (Continued)

Criteria	Definition	Parameter	Scoring
	3.3 For prevention: Risk reduction or preventive capacity provided by the proposed intervention to the population	Effectiveness of the intervention to prevent the disease	5 = higher than 90% 4 = 81 – 90% 3 = 71 – 80% 2 = 61 – 70% 1 = less than 60%
4. Variation in practice	Variation of implementing the intervention in practice that leads to unequal accessibility to the intervention among Thais. Variation in practice could be identified from the different coverage of the three publicly funded health insurance schemes in Thailand and/or could be identified from the different distribution of the intervention throughout the country.	The difference of the benefit packages between the 3 health insurance schemes in Thailand The difference of health interventions distribution	5 = national evidence presenting variation in practice in Thailand 4 = national evidence presenting variation in practice in some areas 3 = international evidence presenting variation in practice in other countries that could assume there is variation in practice in Thailand 2 = no evidence but we could assume there is variation in practice in Thailand 1 = no variation in practice
5. Economic impact on household expenditure	Impact on household expenditure as a consequence of providing health intervention to a f amily member with consideration of catastrophic illness or health catastrophe.	Direct medical and non-medical household expenditure as a consequence of the disease or health problem per year	5 = higher than 62,500 baht/year 4 = 35,601 – 62,500 baht/year 3 = 20,801 – 35,600 baht/year 2 = 12,000 – 20,800 baht/year 1 = less than 12,000 baht/year
6. Equity/ ethical and social implication	Priorities for specific groups of patients i.e. the poor with rare disease, reflect the moral values that should be considered by policy makers.	Disease of the poor Prevalence < 1,000 (Rare disease)	5 = targeting the poor & prevalence < 1,000 4 = targeting the poor & prevalence 1,000 – 10,000 3 = targeting the poor & prevalence > 10,000 2 = not targeting the poor & prevalence < 1,000 or not targeting the poor & prevalence 1,000 – 10,000 1 = not targeting the poor & prevalence > 10,000

QoL – Quality of life;

Step 3: Technology assessment of interventions

The research team proposed another set of criteria (assessment criteria) for detailed assessment of the nine interventions. In addition to the review results from the international literature (Table 1), the research team also put forward results of a recent study on the criteria and its weight (elicited by Discrete Choice Experiments; DCE) for priority setting, as conducted in Thailand [22]. This study suggested the following criteria to be important: type of intervention (classified by the objective of intervention i.e. prevention or treatment), target group of intervention (classified by age group), severity of disease, number of beneficiaries, value for money, and budget impact. The research team considered all criteria, and argued that – because the assessment criteria in the present step follow-up on the selection criteria used in step 2 – overlap should be avoided. Upon careful assessment of all criteria and deliberation, the research team came to the consensus to use two assessment criteria: 'value for money' and 'budget impact'. Because of the numerical nature of these two criteria, the research team decided they were not further scaled.

- *Value for money*. The criterion 'value for money' refers to the maximization of health outcomes given a certain budget, and is an often-cited criterion for priority setting [13, 14, 23]. The research team defined the criterion in terms of incremental cost per QALY (so called Incremental Cost-Effectiveness Ratio; ICER) to allow comparison across a broad range of interventions.

- *Budget impact*. The research team considered affordability of inclusion of an intervention in the UC benefit package to be important. This criterion addresses the budget impact by estimating the financial consequences of adoption and diffusion of a new intervention within a specific setting, while considering the fiscal capacities of the health plan [24, 25].

The SCBP then approved these two criteria to be used in the assessment. Subsequently, the research team assessed the nine interventions in terms of their value for money (ICER) and budget impact (Table 3), and collaborated

with external experts and relevant stakeholders for each intervention for that purpose. The ICERs were calculated following health economic evaluation guidelines in Thailand [26], and were therefore reliable and comparable.

In addition, the SCBP also requested information of the performance of all nine interventions on the selection criteria (as discussed above) – these were also considered in the appraisal of the interventions.

Step 4: Appraisal of interventions

In the fourth step, in July-August 2010, the research team presented the results of the assessment of nine interventions to the SCBP for appraisal, i.e. for final decision on inclusion of interventions in the benefit package (Table 3). The SCBP members elaborated upon these assessments, and discussions focused on three major issues: which costs were included in the models, whether the most cost-effective alternative intervention of each disease was already covered in the benefit package and whether the proposed intervention would be feasible for implementation. They considered a threshold of one time gross domestic product (GDP) per capita (approximately US$4,500 in 2010 [27]) per QALY gained as good value for money. Table 4 shows the relationship between the results of step 3 (technology assessment) and those of step 4 (appraisal). Two out of nine interventions were analysed in terms of costs only (one of them was recommended by the SCBP), and their results are also not included in Table 4. Of the other seven interventions, the SCBP agreed to recommend three interventions for further consideration to be adopted under the UC scheme (Table 4) because they were cost-effective with low budgetary impact. At the same time, for two out of these three interventions it was found that cost-effective alternatives were already covered under the benefit package (i.e. Lamivudine for treating people with chronic hepatitis B and Intravenous cyclophosphamide + Azathioprine for treating severe lupus nephritis).

The other four interventions were not selected for a number of reasons. Some interventions (i.e. treatment for people with chronic hepatitis C, and absorbent products for urinary and fecal incontinence among disabled and elderly people) were cost-effective but the budgetary impact of the intervention

was considered too high. One intervention 'anti-immunoglobulin E for severe asthma' was not cost-effective with high budgetary impact. Finally, the intervention 'implant dentures for people who have problems with conventional complete dentures' was cost-effective but the SCBP denied to appraise it because there had been poor service accessibility to current alternatives that would first need to be solved. No intervention yielding ICER higher than 1 GDP per capita per QALY gained was recommended for the benefit package.

Table 3 Health intervention assessment results and policy recommendations

	Results*		
Health interventions	Cost-utility analysis	Budget impact analysis	Policy recommendations
1. Treatment for people with chronic hepatitis B	Lamivudine (produced by GPO) is the most cost-effective (cost-saving) compared to palliative care and to the other alternatives; - Lamivudine (original), - Adefovir + Lamivudine (GPO), - Entecavir, - Telbivudine, and - Pegylated interferon alpha	The budget of providing Lamivudine (GPO) is THB 50 million higher than providing palliative care in a first year of implementation, and will increase to THB 500 million at the 5th year.	The most cost-effective intervention for treating chronic hepatitis type B, Lamivudine, has already been covered under the benefit package.
2. Treatment for people with chronic hepatitis C	Pegylated interferon alpha 2a (Peg2a) + Ribavirin for treating hepatitis type C subtype 1, 4, 5, and 6 is the most cost-effective (ICER=THB 86,600/QALY) compared to palliative care and to other alternatives; - Interferon alpha + Ribavirin, Peg2a + Ribavirin, Pegylated interferion alpha 2b (Peg2b) 1 g/1 kg of body weight + Ribavirin, Peg2b 1.5 g/1 kg of body weight + Ribavirin	Providing Peg2a for treating hepatitis type C subtype 1, 4, 5, and 6 is increasing budget by THB 3,500 million. Providing Peg2b for treating hepatitis type C subtype 3 is increasing budget by THB 8,600 million. Therefore, it would be in total THB 12,000 million within 5 years.	Not recommended because of high budget impact.
3. Treatment for severe lupus nephritis	Intravenous cyclophosphamide (IVC) + Azathioprine (AZA) for 3 years is the most cost-effective (cost-saving) compared to the standard treatment for treating lupus nephritis (IVC with decreasing dose for 3 years), and to the other alternatives (i.e. IVC + Mycophenolate mofetil (MMF) for 3 years, MMF + AZA for 3 years, MMF with decreasing dose for 3 years).	Budget of treatment is approximately THB 1.4 – 1.5 million per patient	The most cost-effective intervention for treating lupus nephritis (i.e. IVC 1,000 mg/month for 6 months and then AZA 50 mg/day for further 2.5 years) has already been covered under the benefit package.

Table 3 (Continued)

Health interventions	Results* Cost-utility analysis	Budget impact analysis	Policy recommendations
4. Smoking cessation program	Every intervention for smoking cessation is cost-effective (cost-saving) (i.e. counseling at the hospital, counseling by quit line, counseling + nicotine gum, counseling + nicotine patch, counseling + Bupropion, counseling + Nortriptyline, and counseling + Varenicline) compared to no intervention (suddenly quit smoking by themselves; smokers).	In case of providing Nortriptyline (as a first line drug) 80% + Nicotine gum 10% + Varenicline (as a second line drug) 10%, the budget would be THB 273 million in a first year and would increase to THB 566 million at the 5th year.	All interventions for smoking cessation are cost-effective. Therefore, the program is recommended for further consideration to be adopted in the benefit package.
5. Anti IgE for severe asthma	Omalizumab (anti IgE) is not cost-effectiveness (ICER= THB 414,503/QALY) compared to standard clinical practice guideline (Steroid) for severe asthma.	Providing Omalizumab to treat severe asthma patients increases budget by THB 54,000 million per year, and will increase the budget by THB 270,000 million within 5 years.	Not recommended because it is not cost-effective intervention and the budget estimation per year is very high.
6. Implant dentures for people who have problem with conventional complete dentures	Implant dentures is cost-effective (ICER=THB 5,147/QALY).	The 5-year budget will be THB 280 – 781 million on the basis of expected target population, and will be THB 83 – 208 million based on human resource (health professionals) capacity.	Not recommended because problems of access to standard treatment of dental care were still unsolved
7. Absorbent products for urinary and fecal incontinence among disabled and elderly people	Absorbent product is cost-effective (ICER= THB 54,000/QALY).	Budget of providing absorbent products to the disabled and elderly is approximately THB 4,800 million per year.	Not recommended because of high budget impact
8. System for screening, treatment and rehabilitation of alcoholism	N/A	N/A	Not recommended because of inadequate information (in 2010)
9. Screening for risk factors for leukemia in people living in the industrial areas	N/A	N/A (the researchers estimated social costs of illness instead: from the model of 50,000 populations who are living in the industrial areas with migration of 1,000 people per year, social costs of illness would be THB 3,500 million in 30 years)	Recommended for further consideration to be adopted in the benefit package because the problem causes considerable loss in terms of cost of illness at THB 3,500 million in 30 years.

GPO: the government pharmaceutical organization; SLE: systemic lupus erythematosus; IgE: immunoglobulin E; ICER: Incremental cost-effectiveness ratio; QALY: Quality adjusted life year; THB: Thai baht; N/A: Not available.
*In 2010, 1 US dollar is approximately 30.17 baht [Bank of Thailand. Foreign Exchange Rates as of 29 December 2010. www.bot.or.th/Thai/Statistics/FinancialMarkets/ExchangeRate/_layouts/Application/ExchangeRate/ExchangeRate.aspx].

Whether this use of MCDA indeed improved rational, transparency and fairness of the priority setting process in Thailand is not easy to judge in the absence of a clear standard on all these aspects. As an alternative, we evaluate the project against the accountability for reasonableness (A4R) framework [6, 7], that specifies conditions for fair decision-making: reasonableness, publicity, revisable, and enforcement. In doing so, the framework considers aspects of rational and transparency at the same time.

The *reasonableness condition* states that the rationale for priority setting decisions must rest on evidence and principles that are accepted as relevant by fair-minded people. In the present project, contributing elements in this were the following: both selection and assessment criteria were identified and approved by a large variety of stakeholders (including consultation panel 1, the research team and the SCBP) on the basis of literature review and careful elaboration, and supported by a previous study

Table 4 The relationship between assessment and appraisal results

Policy recommendation	Assessment results*			
	Cost-effectiveness (ICER ≤ 1 per-capita GDP/QALY)		Not cost-effectiveness (ICER > 1 per-capita GDP/QALY)	
	Low budget impact**	High budget impact**	Low budget impact	High budget impact
Recommended	• Lamivudine for treatment for people with chronic hepatitis B • Intravenous cyclophosphamide + Azathioprine for treating severe lupus nephritis • Smoking cessation program	-	-	-
Not recommended	• Implant dentures for people who have problem with conventional complete dentures	• Pegylate interferon alpha 2 a + Ribavirin for treating hepatitis C • Absorbent products for urinary and fecal incontinence among disabled and elderly people	-	• Anti immunoglobulin E for severe asthma

*Two cost analysis studies, i.e. screening for risk factors for leukemia in people living in the industrial areas, and system for screening, treatment and rehabilitation of alcoholism, are not included in this table.
**High budget impact >THB 200 million per annum; low budget impact ≤ THB 200 million per year
ICER: Incremental Cost-Effectiveness Ratio; GDP: Gross domestic product; QALY: Quality-adjusted life year

on priority setting criteria in Thailand [22]. In addition, the definition and scales of the criteria were adapted to the Thai context, and the performance of interventions on every criterion was supported by available local evidence. Also, the nomination, selection for assessment and final priority setting was based on elaboration among a wide variety of stakeholders in working groups – the latter is described as a key aspect of fair processes (28). Limiting elements were that the project did observe some difficulties in the working groups as to identify truly representatives of various stakeholders, e.g. that of lay people. Also, while the project involved a range of stakeholders in its consultation panels and working groups in steps 1-3, the SCBP eventually made decisions itself and it is not sure to what extent the final decisions still reflect the stakeholders' preferences.

The publicity condition prescribes that rationales for priority setting decisions must be publicly accessible. The present project communicated information on criteria and the selection of interventions for assessment to stakeholders and the general public through newsletter, chapters in the newspaper, formal letters, and organizational websites. However, the reasons underlying the final decisions regarding the adoption of interventions in the package were not explicitly acknowledged. As a result, the working groups had requested the SCBP to provide them an official letter explaining why particular interventions were in- or excluded in the benefit package, and subsequently, the SCBP reluctantly accepted it. Although this is a way of sharing the message to the public, there is a need for an assessment of the effectiveness of this mode of communication in the future. The *revisable condition* allows for challenging the decisions and giving opportunities for revision and improvement of policies in the light of new evidence. Yet, the present project did not have a systematic appeal mechanism to challenge the coverage decisions. Nevertheless, the process information and the criteria involved in the original decision are publicly accessible and allow the general public to express their dissatisfaction. This can lead to reconsidering the decisions in light of new evidence and better arguments. The *enforcement condition* can be either voluntary or regulation of the process to ensure that the first three abovementioned conditions are met. Based on the one-year experience, there was no rule and regulation to reach this condition.

Discussion

This research and development project, initiated by NHSO in Thailand, and is a first attempt to achieve rational, transparent and fair health care rationing through the application of MCDA in a real-world context. MCDA was applied in the various steps throughout the project to identify (selection and assessment) criteria, to construct performance matrixes and to elaborate on these before coming to final conclusions. Although it is difficult to judge in the absence of quantified standards, MCDA seems to have considerably contributed to fairness in priority setting. The merits of MCDA are especially clear when the present process is compared to the situation before where priority setting was said to be ad-hoc and driven by interests of stakeholder groups.

Deliberation is an important component of MCDA. Whereas the performance matrix quantifies the performance of interventions on selected criteria, the consideration of other criteria (that cannot be quantified or were for other reasons missing in the performance matrix) is vital in MCDA and is captured in the process of deliberation. As an example, the intervention 'absorbent products for urinary and fecal incontinence among disabled and elderly people' was selected for assessment, even though its score was not in the top rank. In the present project, criteria like 'vulnerability', 'a more cost-effective alternative', and 'feasibility of implementation' were put forward in the deliberation process in step 2 (selection of interventions for assessment).

This paper described the first year of experience only of the use of MCDA to develop the UC benefit package, and did not capture the final coverage decisions. The SCBP is now consulting with the tobacco research and knowledge management center in Thailand to make the 'smoking cessation program' part of the tobacco prevention program. Likewise, the SCBP is now consulting with the NHSO's department of health promotion and disease prevention to incorporate the screening programme for leukemia in their regular work. Both interventions still need further consideration before they can be covered under the UC scheme. As to the 'absorbent products for urinary and fecal incontinence among disabled and elderly

people', initially the SCBP members seemed to support coverage of this intervention upon the ethical aspects, i.e. the clear need for this intervention when the assessment was on-going in 2010. This intervention was finally denied by the SCBP for inclusion because of its large budget impact (SCBP meeting in July 2011).

Our study has a number of limitations. First, the scoring scales of some criteria were difficult to define, such as targeting the poor and those with rare diseases. A clear definition of both terminologies was lacking; therefore, in this project, the definition and scoring scales development were determined on the basis of experts' opinion and the international guideline i.e. World Health Report 2002 [21]. Although these two information sources are acceptable, country-specific and more reliable evidence for creating the criteria's and the scoring scales' definition should be developed. Second, we found a lack of comparable evidence of each intervention on the severity of disease criterion. As it would be costly and time consuming to conduct an empirical study for all proposed interventions, only partial information and expert opinion on this criterion was considered. While severity of disease has been widely used in priority setting to balance between equity and efficiency in many settings [29-31]; this limitation has led to a doubt in using this criterion in MCDA. Hence, this flags serious attention for its further measurement. Third, some criteria, like effectiveness, were difficult to understand for non-academic people – this constituted a barrier to achieving consensus in group discussions as lay people were dominated by higher educated people. The project however did not consider this reason to delay involving the public in the process of priority setting, and informed all stakeholders as much as possible on the way. Fourth, all criteria used in this project were determined to carry equal weights, which may not reflect the local values in reality. Although the relative weights of criteria analyzed from the DCE were considered by the research team and the SCBP, they were not used directly - weighing of criteria may be considered in future projects. Then, the question should also be addressed how the potentially divergent weights from the various stakeholders can be accommodated. Fifth, the framework of A4R was purposively selected to evaluate the prioritization process of the project. However, there are other evaluation

tools that can be applied for assessing the resource allocation process such as a framework of internal and external parameters for evaluating successful priority setting in low and middle income countries [32], and a checklist for assessing nine common themes of good practice for health research priority setting [33].

It is noteworthy that a decision making on itself is a dynamic process, and some intervention performance on some criteria used e.g. severity of disease, effectiveness of interventions, or economic impact of household expenditure are likely to change overtime. For example, changing population structure can lead to increase or decrease of some disease incidence, or availability of new intervention can lead to the change of costs of existing intervention. This can be drawn from the case of 'Pegylate interferon alpha 2a and Ribavirin for treating hepatitis C' that was not recommended at the initial decision making because of its high budgetary impact. However, at the end of 2011, this combined intervention for treating hepatitis C was eventually included in the benefit package because the lower price of the intervention, due to extensive price negotiation between the Thai Ministry of Public Health and pharmaceutical companies, resulted in a lower budget impact. Hence, priority setting of interventions is a continuous process. It also means that some interventions that failed to be prioritized in the first place may need to be reconsidered again in the future as they may become priorities then.

Although the present project has applied MCDA in the Thai context, MCDA – as a general approach - is applicable or adaptable to other settings. This would require identification of priority setting criteria as relevant to that setting, including assigning weights and/or scores for each criterion, and the assessment of performance of all interventions on these criteria, to arrive at a context-specific priority setting process. That would then not only in Thailand but also in other settings lead to decisions that are more rational, transparent and fair.

References

1. Ham C. Priority setting in health care: Learning from international experience. Health Policy. 1997; 42: 49-66.
2. Pitayarangsarit S. The introduction of the universal coverage of health care in Thailand: Policy responses. London: London school of hygiene and tropical medicine, 2005.
3. National Health Security Office. Meeting of the Subcommittee for the Development of Benefit Packages and Service Delivery. 2/2009 ed. Ministry of Public Health, Thailand, 2009.
4. Baltussen R, Niessen LW. Priority setting of health interventions: the need for multi-critieria decision analysis. Cost Effectiveness and Resource Allocation. 2006; 4: 14.
5. Devlin N, Sussex J. Incorporating multiple criteria in HTA: methods and processes. London: Office of health economics, 2011.
6. Daniels N, Sabin JE. Accountability for reasonableness. In: Daniels N, Sabin JE, eds., Setting limits fairly: Can we learn to share medical resources? New York: Oxford University Press, 2002.
7. Daniels N. Just health: Meeting health needs fairly. New York: Cambridge University Press, 2008.
8. Youngkong S, Kapiriri L, Baltussen R. Setting priorities for health interventions in developing countries: A review of empirical studies. Tropical Medicine and International Health. 2009; 14: 930-39.
9. Ubel PA. Pricing life: why it's time for health care rationing. Massachusetts: The MIT Press, 2000.
10. Musgrove P. Public spending on health care: how are different criteria related? Health Policy. 1999; 47: 207-23.
11. Teerawattananon Y, Russell S. The greatest happiness of the greatest number? Policy actors' perspectives on the limits of economic evaluation as a tool for informing health care coverage decisions in Thailand. BMC Health Services Research. 2008; 8: 197.
12. Tongsiri S, Cairns J. Estimating Population-Based Values for EQ-5D Health States in Thailand. Value in Health. 2011; (in press).
13. Musgrove P, Fox-Fushby J. Cost-effectiveness analysis for priority setting. In: Jamison DT, Breman JG, Measham AR, et al., eds., Disease control

priorities in developing countries. 2nd ed. New York: Oxford University Press, 2006.
14. Mitton CR. Priority setting for decision makers: Using health economics in practice. European Journal of Health Economics. 2002; 3: 240-43.
15. Prakongsri P, Limwattananon S, Tangcharoensathien V. The equity impact of the universal coverage policy: Lessons from Thailand. Advances in Health Economics and Health Services Research. 2009; 21: 57-81.
16. Kutzin J. Towards universal health care coverage: A goal-oriented framework for policy analysis. Washington, DC: The World Bank, 2000.
17. Mills A. Strategies to achieve universal coverage: Are there lessons from middle income countries? . Geneva: Commission on Social Determinants of Health, World Health Organization, 2007.
18. Russell S. Ability to pay for health care: Concepts and evidence. Health Policy and Planning. 1996; 11: 219-37.
19. Wagstaff A, Doorslaer Ev. Catastorphe and impoverishment in paying for health care: with applications to Vietnam 1993-1998. Health Economics. 2003; 12.
20. National Statistical Office. Household socio-economic survey. Bangkok: Office of the Prime MInister, 2008.
21. World Health Organization. The world health report 2002: Reducing risks, promoting healthy life. Geneva: World Health Organization, 2002.
22. Youngkong S, Tromp N, Chitama D. The EVIDEM framework and its usefulness for priority setting across a broad range of health interventions. Cost Effectiveness and Resource Allocation. 2011; 9: 8.
23. Drummond M, Jönsson B, Rutten F. The role of economic evaluation in the pricing and reimbursement of medicines. Health Policy. 1997; 40: 199-215.
24. Trueman P, Drummond M, Hutton J. Developing guidance for budget impact analysis. Pharmacoeconomics. 2001; 19: 609-21.
25. Mauskopf J, Sullivan S, Annemans L, et al. Principles of good practice for budget impact analysis: Report of the ISPOR task force on good research practices - Budget Impact Analysis. Value in Health. 2007; 10: 336-47.
26. Ministry of Public Health. Health economics evaluation guidelines in

Thailand. Nonthaburi: The Graphic System Press, 1999.
27. Bank of Thailand. Thailand's macroeconomic indicators. Bangkok: Bank of Thailand, 2012.
28. Daniels N, Sabin JE. Setting limits fairly: Can we learn to share medical resources? New York: Oxford University Press, 2002.
29. Jehu-Appiah C, Baltussen R, Acquah C, et al. Balancing equity and efficiency in health priorities in Ghana: the use of multicriteria decision analysis. Value in Health. 2009; 11: 1081-87.
30. Stolk E, Poley M. Criteria for determining a basic health services package: Recent developments in the Netherlands. European Journal of Health Economics. 2005; 50: 2-7.
31. Dolan P, Shaw R. A note on the relative importance that people attach to different factors when setting priorities in health care. Health Expectation. 2002; 6: 53-59.
32. Kapiriri L, Martin DK. Successful priority setting in low and middle income countries: A framework for evaluation. Health care analysis 2010; 18: 129-47.
33. Viergever RF, Olifson S, Abdul G, et al. A checklist for health research priority setting: nine common themes of good practice. Health Research Policy and Systems. 2010; 8: 36.

Appendix 1 Scores of the proposed health interventions against the selection criteria

Health interventions	The reviewed organizations						
	Size of population affected by disease	Severity of disease*	Effectiveness of health intervention	Variation in practice	Economic impact on household expenditure	Equity/ethical and social implication	Total
1. Anti-immunoglobulin E for severe asthma	4	-	3	5	5	1	18
2. Treatment for people with chronic hepatitis B	5	-	4	2	3	3	17
3. System for screening, treatment and rehabilitation of alcoholism	5	-	5	4	1	1	16
4. Implant dentures for people who have problem with conventional complete dentures	5	-	2	2	5	1	15
5. Screening for risk factors for leukemia in people living in the industrial areas	4	-	3	5	1	2	15
6. Treatment for severe lupus nephritis	2	-	4	2	5	1	14
7. Smoking cessation program	5	-	3	2	1	3	14
8. Treatment for people with chronic hepatitis C	3	-	5	2	3	1	14
9. Absorbent products for urinary and fecal incontinence among disabled and elderly people	4	-	2	2	4	1	13
10. Treatment for infertilized women	5	-	0	2	5	1	13
11. Renal replacement by dialysis for new final stage renal failure patients	2	-	1	5	4	1	13
12. Screening and treatment for liver cancer	2	-	3	2	5	1	13
13. Physical examination package (following the Civil Servant Medical Benefit Scheme)	5	-	0	5	1	1	12
14. Cissus quadrangularis L. for hemorrhoid	5	-	1	4	1	1	12
15. Biological agents for psoriasis	1	-	1	2	5	2	11
16. Screening for gall bladder cancer	2	-	2	2	1	3	10
17. Orbital implant and Plastic surgery of orbit and facial bones	1	-	2	1	1	2	7

*Severity of disease was omitted from the criteria list in the first year of the project (2010).

CHAPTER 7

The EVIDEM framework and its usefulness for priority setting across a broad range of health interventions

Sitaporn Youngkong
Noor Tromp
Dereck Chitama

Cost Effectiveness and Resource Allocation 2011; 9: 8

Abstract

This commentary responds to the article by Goetghebeur et al., which applies the EVIDEM (Evidence and Value: Impact on DEcision-Making) framework to evaluate growth hormone therapy for Turner syndrome patients. While we value the qualities of the EVIDEM because of its scope and breadth, we have doubts on the results consistency of the EVIDEM to compare competing interventions, particularly when setting priorities across broad healthcare service areas (e.g. in designing the national health benefit package) for two main reasons. First, the EVIDEM framework ignores the contextual nature of priority setting process by assuming a set of universal priority setting criteria. Secondly, the EVIDEM is vulnerable to interventions ranking inconsistency where performance evaluation of a broad range of competing interventions is mandated. To address its limitations, we propose a stepwise process to identify criteria and their weights, and rank ordered interventions.

Commentary

This commentary responds to the article by Goetghebeur et al [1], which applies the EVIDEM (Evidence and Value: Impact on DEcision-Making) framework to evaluate growth hormone therapy for Turner syndrome patients. The EVIDEM framework is developed to assist decision-makers in healthcare decisions, and encompasses a multi-criteria decision analysis (MCDA) matrix consisting of 15 quantifiable, and six qualitative components of decision. With this comprehensive set of criteria, relevant experts can assess the performance of health interventions, and results are input for informed and transparent healthcare decisions.

Goetghebeur et al [1] propose that the EVIDEM can be used to compare various interventions across disease areas in order to prioritize interventions. They suggest that the EVIDEM can analyze single interventions, and the performance of competing interventions can subsequently be compared in a performance matrix. While we value the qualities of the EVIDEM because of its scope and breadth, we have doubts on the results consistency of the EVIDEM to compare competing interventions, particularly when setting priorities across broad healthcare service areas (e.g. in designing the national health benefit package) for two main reasons.

First, the EVIDEM framework ignores the contextual nature of priority setting process by assuming a set of universal priority setting criteria [2]. In reality, the priority setting process is context specific and different sets of criteria lead priority setting of health interventions in different contexts. As the examples of studies in Nepal [3], Chile [4], and Ghana [5] show, the set of criteria identified for using in priority setting of health interventions were different between countries. Therefore, we suggest that the setting of prioritization criteria needs to be locally determined or verified, implying that the EVIDEM needs to be flexible to allow change/modification of the components to suit the local context.

Secondly, the EVIDEM is vulnerable to interventions ranking inconsistency where performance evaluation of a broad range of competing interventions

is mandated. For example, the EVIDEM framework requires different expert panels to assess the performance of every single intervention separately. This may lead to inconsistency of the results as different expert panels may have different considerations across the broad range of interventions to be assessed. As shown in the EVIDEM Turner Syndrome case study [1], the panel of experts estimated growth hormone intervention to achieve 41% of maximum value. However, in the absence of established explicit weights of criteria, it is not certain that the same panel will be consistent in evaluating different interventions, or that another panel of experts comes up with the same or similar value.

These arguments raise the question whether the approach of EVIDEM is locally meaningful and consistent when priorities are set for a range of interventions. To address its limitations, we propose a stepwise process to identify criteria and their weights, and rank ordered interventions.

We suggest that, to set priorities of a range of interventions within a certain context, a locally-meaningful set of criteria and their relative importance (i.e. weights) should be elicited by consulting relevant stakeholders. As a next step, the identified set of criteria and weights are then used to consistently assess the performance of the broad range of interventions.

To illustrate the method, we describe a study in Thailand [6], which defined explicit criteria to prioritize health interventions for the national health benefit package. Our study was conducted in five main steps. First, in a group discussion among multi-stakeholders, the six most important prioritization criteria (and their levels) were identified i.e. type of intervention, target groups of intervention, severity of disease, number of beneficiaries, value for money, and budget impact. This step ensured that the criteria were verified for the Thai context. Second, based on those six criteria, we designed a discrete choice experiment (DCE) questionnaire, an approach that facilitates MDCA, and distributed this among 24 national health policymakers, 55 health professionals, and 163 general populations. Third, our DCE analyses resulted in odds ratios (OR) per criterion level (i.e. target group criterion contains three levels: elderly, adult and children). The

OR indicated the relative importance of incremental changes in criterion levels (compared to a reference level), to select an intervention (Table 1). For example, policymakers are 5.73 times more likely to select health interventions that target the children than interventions targeting the elderly. In this way the criteria and their weights were the same for every health intervention, and ranking consistency was achieved. Fourth, from the DCE results, we calculated the interventions' probability of being selected, by combining the performance of interventions on each criterion and the importance of that criterion. The probability of being selected resulted in a rank ordering of health interventions. Fifth, the rank ordering was an important input in an elaborative process among policymakers. In the study, we presented the different rank orderings from those three perspectives of stakeholders to policymakers for more elaborative discussion. This included consideration of non-quantifiable criteria in reaching consensus on the final health interventions priority list for the national health benefit package.

The explicit weighing of criteria analyzed from DCE may improve the consistency of priority setting across contexts and over time, but does not solve the more fundamental problem that views of stakeholders, and therefore their expressed criteria and weights, may diverge. This is acknowledged by the 'Accountability for Reasonableness' (A4R) framework [7, 8] which is based on the believe that any consensus on priority setting weights and subsequent results may be difficult to achieve because of these distinct perspectives of stakeholders. Instead of attempting to resolve the problem of diverse stakeholders' views, the A4R framework proposes to concentrate on a fair priority setting process. On this basis, when conditions of reasonableness, publicity, appeal and enforcement are satisfied, it would lead to decisions that are considered fair and acceptable to stakeholders. In our view, exploring how stakeholders' divergent perspectives on the weighting of criteria can be met fairly, is an object for further research.

In summary, the framework of EVIDEM can be a useful tool to assess single intervention or to prioritize between only few interventions; however, in this paper, we place emphasis on the potential of DCE for consistently setting priorities between a range of interventions at once and its meaningfulness across different contexts.

Table 1 Relative importance (Odds ratios) of criteria by perspective

Criteria	Levels	Perspectives (Odds ratios)		
		Policy makers	Health professionals	General population
Type of intervention	Prevention for non-communicable diseases			
	Prevention for communicable diseases	**	2.50*	1.56*
	Treatment for non-communicable diseases	**	1.22	1.13
	Treatment for communicable diseases	**	1.88	1.41
Target group of intervention	Elderly			
	Adult	3.71*	3.93*	2.40*
	Children	5.13*	2.92*	2.45*
Severity of disease	Not severe			
	Moderate severe	6.29*	4.24*	2.48*
	Severe	43.42*	6.00	2.06*
Number of beneficiaries	Few			
	Many	19.97*	8.64*	2.80*
Value for money	High cost but low effectiveness			
	High cost and high effectiveness	48.91*	23.27*	9.35*
	Low cost and low effectiveness	1.35*	2.28*	1.51*
	Low Cost but high effectiveness	31.60*	27.97*	12.96*
Budget impact	High budget impact			
	Low budget impact	9.91*	4.43*	4.25*
Log likelihood		-199.5608	-637.7022	-2301.6025
Pseudo R^2		0.5065	0.3341	0.2055

*Significant variables ($p < 0.05$)
**Removed variable
Note:
1. The odds ratios were overestimated because of the small sample size of policy makers. However, there was no any relevance for the interpretation of the results.
2. The group of policy makers expressed higher preference on the high cost and highly effective interventions rather than the low cost with highly effective ones. The explanation of this is reported elsewhere.

References

1. Goetghebeur M, Wagner M, Khoury H, Rindress D, Grégoire J-P, Deal C: **Combining multicriteria decision analysis, ethics and health technology assessment: applying the EVIDEM decisionmaking framework to growth hormone for Turner syndrome patients.** Cost Effectiveness and Resource Allocation 2010, 8:4.
2. Goetghebeur M, Wagner M, Khoury H, Levitt R, Erickson L, Rindress D: **Evidence and value: Impact on DEcisionMaking - the EVIDEM framework and potential applications.** BMC Health Services Research 2008, 8:270.
3. Baltussen R, Asbroek AHAt, Koolman X, Shrestha N, Bhattarai P, Niessen L: **Priority setting using multiple criteria: should a lung health programme be implemented in Nepal?** Health Policy and Planning 2007, 22:178-185.
4. Vargas V, Poblete S: **Health prioritization: The case of Chile.** Health Affairs 2008, 27:782-792.
5. Jehu-Appiah C, Baltussen R, Acquah C, Aikins M, Amah d'Almeida S, Bosu W, Koolman X, Lauer J, Osei D, Adjei S: **Balancing equity and efficiency in health priorities in Ghana: The use of multicriteria decision analysis.** Value in Health 2008, 11:1081-1087.
6. The International Health Policy Program, Health Intervention and Technology Assessment Program: **Research for development of health benefit package under universal health care coverage scheme: Issue 1.** Nonthaburi; 2011.
7. Daniels N: **Accountability for reasonableness: Establishing a fair process for priority setting is easier than agreeing on principles.** BMJ 2000, 321:1300-1301.
8. Daniels N: **Just health: Meeting health needs fairly.** New York: Cambridge University Press; 2008.
9. Friedman A: **Beyond accountability for reasonableness.** Bioethics 2008, 22:101-112.

CHAPTER 8

Multi-criteria decision analysis to prioritize health interventions: Capitalizing on first experiences

Rob Baltussen
Sitaporn Youngkong
Francesco Paolucci
Louis Niessen

Health Policy 2010; 96: 262-264

Abstract

This paper capitalizes on a first set of experiences on the application of multi-criteria decision analysis (MCDA) in seven low-and middle-income settings. It thereby reacts to a recent paper by Peacock et al., highlighting the potential of MCDA to guide policy makers in highly specific decision-making contexts. We argue that MCDA also has a broader application in setting priorities in health, i.e. to indicate general perceptions on priorities without defining the allocation of resources in a precise fashion. This use of MCDA can have far-reaching and constructive influences on policy formulation.

Keywords

Priority setting, Multi-criteria decision analysis

Introduction

This paper capitalizes on a first set of experiences on the application of MCDA in seven low-and middle-income settings [1–7], building upon the conceptual basis of MCDA in health as described elsewhere [8]. It thereby responds to a recent paper by Peacock et al. [9] in this journal, in which the authors elaborate on the use of interdisciplinary methods to set priorities in health, and thereby highlight the potential of MCDA. We qualify a number of observations by Peacock et al. [9] on the types of policy questions MCDA can address, and on methodological aspects of MCDA. We also elaborate on the construction of a global database on intervention priorities.

Types of policy questions

Priority setting is sometimes referred to as a generic process on the rank ordering of interventions [10], but in reality covers a wide variety of policy questions at different levels of the health system. We distinguish two broad applications of priority setting studies: first, priority setting can be undertaken to inform policy makers in a specific context on e.g. the reimbursement of a single intervention, or to prioritize between only a few interventions, either at the national, sub-national or institutional level in a country. These decisions are taken in the presence of a known budget and might be limited by factors such as the currently available physical infrastructure, human resources or political consideration, at least in the short-to medium-term [11]. We label this 'context-specific priority setting'. These are also the type of policy questions Peacock et al. [9] refer to, and that programme budgeting and marginal analysis (PBMA) has traditionally and successfully addressed in a large number of studies in the past [12]. Indeed, as Peacock et al. [9] suggest, MCDA can play a role in this process to make decision-makers objectives and their value trade-offs consistent and transparent.

The second application of priority setting studies in a country, which goes beyond the scope of PBMA [9],is to guide decisions on a wide range of interventions, to provide general information on their relative rank ordering to arrive a more informed debate on resource allocation priorities.

Because it is not meant to provide a solution to a specific resource allocation question, it need not be highly contextualized in terms of e.g. physical infrastructure and/or human resources constraints. Such general perceptions on priorities can have far-reaching and constructive influences on policy formulation, defining the set of options that are debated without defining the allocation of resources in a precise fashion. We label this 'generalized priority setting' (cf. Murray et al. [13]). In this context, MCDA can serve different aims. It can e.g. be used to elicit and define general, national-level, criteria for priority setting (and indicate their relative importance). The definition of such criteria makes the rationale of national-level priority setting decisions explicit, and thereby adds to the accountability and transparency of its process [14]. It follows up on the example of the Dunning committee in the Netherlands, that defined a funnel including four sieves (necessity, effectiveness, cost-effectiveness, and self-responsibility) that interventions need to pass to be included in a national insurance package [15]. As another example, Ghana has used criteria as identified through MCDA, to set its intervention priorities in the Ghana Health Sector Plan of Work 2007–2012 [3].

One step further, and perhaps the most important contribution of MCDA in the realm of generalized priority setting, is to provide broad classifications of interventions within a specific disease area. Applications include priority setting in HIV/AIDS control in Thailand [4], and across a broad set of interventions to guide decisions at the national-level in Ghana [1,3], China [5], Brazil [6], and Cuba [7]. However, because of its nature, MCDA can weigh the relative importance of quantifiable criteria only, and an initial rank ordering of interventions may only be based on those. Yet, it is obvious that any priority setting process should also account for non-quantifiable criteria such as ethical judgments [16], and these can be accounted for through a process of elaboration. In such a process, intervention ranks are discussed and

can be modified, and this has been successfully tested in the prioritization of HIV/AIDS interventions in Thailand [4]. The resulting rank ordering – taking into account both quantitative and qualitative criteria – can then be a useful basis for policy making. Yet, such a ranking should never be interpreted in a formulaic sense given the political economic realm in which priority setting is taking place [11], and which may add further (irrational) criteria to the process. Instead, the resulting rank order of interventions might be best presented in three classifications: those that are 'priorities', those that are 'not priorities', and those that are in between (cf. classification of HIV/AIDS interventions in Thailand, Center for Global Development [17]). This information provides policy makers with broad indications of intervention (groups) that may be candidates for implementation (to foster the transparency of results, the performance of intervention on the individual criteria should also be made available to policy makers). Again, the availability of such information adds to the accountability and transparency of the priority setting process [14].

Whereas PBMA, by its nature, is in the literature typically related to 'context-specific priority setting', some exceptions exist. For example, an Australian study to guide decisions on the inclusion of eight interventions in the next cancer control strategy has been referred to as a PBMA study, while the study only provided broad descriptions of criteria and broad indications on the overall attractiveness of interventions [20]. However, what is or is not a PBMA study may not be of prime importance here, and may be an issue of semantics. Most important observation here is the conceptual distinction between 'context-specific priority setting' and 'generalized priority setting', and

Methodological aspects

Peacock et al. [9] highlight the importance of participatory action research, and the involvement of stakeholders in decisions on intervention priorities.

The inclusion of perspectives of relevant stakeholders – and where possible the achievement of consensus – is indeed important, to improve accountability, credibility and acceptability of results by society [14,18,19]. The recent MCDA study on the prioritization of HIV/AIDS interventions in Thailand followed up on this, and revealed important differences between preferences of policy makers, people living with HIV/AIDS, and lay people [4]. The study did not aim to reach consensus between the stakeholders, and within the studies referred to above, there is no experiences yet on how to do so. It is not sure whether the process of elaboration may be useful in this respect given the risk of dominance of one group of stakeholders (less-experienced e.g. lay people) by another (well-educated and more-experienced e.g. policy makers).

The recent experiences show that different studies have identified different criteria for priority setting. This may reflect real differences in preferences between countries, but may also reflect differences in methodological approaches. Some studies [1–4] identified criteria through focus group discussions, and relevant criteria may be omitted because they have not been put forward strong enough or because participants may have simply forgotten to mention them. Other studies identified criteria on the basis of theory and the literature reviews [5–7,21], which may result in sets of different criteria than those relevant in the study context. One way forward is the definition of a comprehensive list of criteria – on the basis of the present experience and other literature – which is then elaborated upon in detail in e.g. a focus group discussion. This approach is currently being conducted in a MCDA priority setting study in Thailand, and proves an effective way to reduce the risk of omission of relevant criteria while also improving comparability of study results between studies (see below).

Towards a global database on intervention priorities

On the one hand, there will never be enough resources available to elicit preferences for criteria in all countries in the world. On the other hand,

a single set of preferences for criteria would not adequately reflect socio-economic and cultural variations explaining these preferences. A question of interest is then whether general patterns exist on the preferences for priority setting criteria (both on the type of criteria, and their relative importance) between countries. Multi-country studies could provide an answer to this, and first explorations are taking place. On the basis of such studies, a global database on the prioritization of interventions could be established, following the example of a WHO-CHOICE database on the cost-effectiveness of interventions [22], but then taking into account multiple criteria. This would then also involve the collection of evidence on the performance of interventions on those criteria. The resulting rank ordering of interventions, including quantitative criteria only, would then give national-level policy makers (very) broad guidance on the relative priority of interventions. Where more detailed is required (sub-)country level analysis should be performed.

Conclusion

Peacock et al. [9] have highlighted the usefulness of MCDA in context-specific priority setting, and we emphasize the potential of MCDA in generalized priority setting. First case-studies show the potential of MCDA to define general, national-level, criteria for priority setting, and provide broad classifications of intervention priorities. Important methodological challenges remain vis-à-vis the inclusion of different stakeholders and a comprehensive set of criteria. The construction of a global database would enable countries around the world to strike a balance between efficiency and equity in their prioritization of health interventions.

References

1. Baltussen R, Stolk E, Chisholm D, Aikins M. Towards a multi-criteria approach for priority setting: an application to Ghana. Health Economics 2006; 15:689–96.
2. Baltussen R, ten Asbroek AH, Koolman X, Shrestha N, Bhattarai P, Niessen LW. Priority setting using multiple criteria: should a lung health programme be implemented in Nepal? Health Policy and Planning 2007;22:178–85.
3. Jehu-Appiah C, Baltussen R, Acquah C, Aikins M, D'Almeida SA, Bosu WK, et al. Balancing equity and efficiency in health priorities in Ghana: the use of multicriteria decision analysis. Value in Health 2009;11:1081–7.
4. Youngkong S, Baltussen R, Tantives S, Koolman X, Teerawattananon T. Criteria for priority setting of HIV/AIDS interventions in Thailand: a discrete choice experiment. In: Abstract Presented at 7th International Health Economics Conference. 2009.
5. Shi Y, Paolucci F, Yu M. Present and future desirability and options in the development of basic packages in China. In: Abstract Presented at 7th International Health Economics Conference. 2009.
6. Soares P, Kinter E, Paolucci F, Ferraz MB, Niessen L. Multi-criteria weighing for health policy conjoint analysis results from a national level workshop of health stake-holders in Brazil. In: Abstract Presented at 7th International Health Economics Conference. 2009.
7. Niessen L, Paolucci F. Compiling evidence from multiple criteria weighing for health policy, the cases of China, Cuba and Brazil. In: Abstract Presented at 7th International Health Economics Conference. 2009.
8. Baltussen R, Niessen L. Priority setting of health interventions: the need for multi-criteria decision analysis. Cost Effectiveness Resource Allocation 2006;4:14.
9. Peacock S, Mitton C, Bate A, McCoy B, Donaldson C. Overcoming barriers to priority setting using interdisciplinary methods. Health Policy 2009;92:124–32.
10. Shah KK. Severity of illness and priority setting in healthcare: a review of the literature. Health Policy 2009;93:77–84.
11. Goddard M, Hauck K, Preker A, Smith PC. Priority setting in health: a

political economy perspective. Health Economics, Policy and Law 2006;1:79–90.
12. Mitton C, Donaldson C. Health care priority setting: principles, practice and challenges. Cost Effectiveness Resource Allocation 2004;2:3.
13. Murray CJ, Evans DB, Acharya A, Baltussen RM. Development of WHO guidelines on generalized cost-effectiveness analysis. Health Economics 2000;9:235–51.
14. Martin DK, Giacomini M, Singer PA. Fairness, accountability for reasonableness, and the views of priority setting decision-makers. Health Policy 2002;61:279–90.
15. Commissie Dunning, Kiezen en delen (in Dutch). Rapport van de Commissie Keuzen in de Zorg. Rijswijk:Ministerie van Welzijn, Volksgezondheid en Cultuur; 1991.
16. Brock D, Wikler D. Ethical issues in resource allocation, research, and new products development. In: Jamison D, Breman JG, Measham AR, editors. Disease control priorities in developing countries. 2nd ed. New York: Oxford University Press and the World Bank; 2006.
17. Center for Global Development. Preventing HIV/AIDS and sexually transmitted infections in Thailand. http://www.cgdev.org/ section/ initiatives/ active/millionssaved/studies/case 2 (accessed on July 16, 2009).
18. Kapiriri L, Norheim OF. Criteria for priority-setting in health care in Uganda: exploration of stakeholders' values. Bulletin of the World Health Organization 2004;82:172–8.
19. McKie J, Shrimpton B, Hurworth R, Bell C, Richardson J. Who should be involved in health care decision making? A qualitative study. Health Care Analysis 2008;16:114–26.
20. Carter R, Stone C, Vos T, Hocking J, Mihalopoulos C, Peacock S, et al. Trial of Program Budgeting and Marginal Analysis (PBMA) to Assist Cancer Control Planning in Australia. Research Report 19, Centre for Health Program Evaluation, Monash University, Melbourne; 2000.
21. Paolucci F. The design of health care financing schemes: implications for affordability and efficiency. Erasmus Repository 2007.
22. WHO-CHOICE. Information available at www.who.int/cea (accessed September 11, 2009).

CHAPTER 9

General discussion

General discussion

The thesis includes a number of studies to guide priority setting of health interventions in Thailand, all using multi-criteria decision analysis (MCDA) as a common approach. Together the studies contribute to the definition of an optimal strategy for priority setting in Thailand.

This final chapter responds to overall research question "What is an optimal strategy to prioritise health interventions in Thailand?" through its responses to the three research sub-questions as defined in the Introduction in Chapter 1. It then provides a number of practical recommendations for an optimal strategy to prioritise health interventions in Thailand, and to enhance the potential use of MCDA in the Thai context. Finally, limitations of this thesis and the need for further research are addressed.

What is the current situation in priority setting in low- and middle-income countries?

Chapter 2 reviewed the empirical studies on priority setting of health interventions, and summarised its characteristics and methodological approaches in low- and middle-income countries (LMIC) in the past decade. The review found that methods for explicit priority setting (e.g. MCDA, accountability for reasonableness - A4R, and the balance sheet method) are all in development. In combination with increasingly available evidence of all sorts on diseases and related interventions, these methods can potentially be solutions for the ad hoc policy making on priority setting in health care in many LMIC. Yet, most of the studies included in our review were small pilot studies and did not include an evaluation of the impact of its findings on actual priority setting. Only when such information becomes available, clear recommendations to scale up certain methods can be given.

The review led to a number of reflections on the current situation in priority setting in LMIC.

1) Most of the studies in this review involved multiple stakeholders in their

priority setting process. This concurred with observations in the literature [1-4] that stressed the need to involve the views of other stakeholders in addition to those of policy makers, especially that of the public, in debates on rationing to enhance the legitimacy and fairness of decision-making.

2) Some studies involved only a limited number of quantitative criteria, whereas observations in the literature [5, 6] stressed that many other criteria, including medical (e.g. effectiveness of interventions and severity of disease) and non-medical (e.g. economic efficiency, ethical reasons and political circumstances) criteria, may also be important and relevant. In addition, some studies identified criteria through literature review, whereas the relevance of criteria is likely to be dependent on culture and perspective.

3) A number of studies relied solely on quantitative techniques, such as discrete choice experiments (DCE), to elicit preferences of respondents. Where the advantage of such techniques is that its results can be applied across interventions, their disadvantage is that not all criteria that are relevant to priority setting are amenable to quantification (not only ethical and social acceptability but also more practical considerations like intervention complexity) and these techniques then fall short of capturing these [7]. A number of studies used qualitative techniques such as deliberative processes. Such techniques have the advantage that they are also able to address non-quantitative concerns and that they explicitly allow the inclusion of views of different stakeholders [8] and the achievement of consensus [7]. The disadvantage is that its results are only relevant to the interventions under study and cannot be generalized across interventions.

4) A number of studies presented their results in mere descriptive format such as identified criteria or respondents' preferences, whereas studies on priority setting have the intrinsic aim to rank-order interventions, or more specifically, to identify interventions that should be included or excluded from, e.g. public reimbursement [6].

The abovementioned review allowed us to provide a number of suggestions on the various aspects of the methodological approaches to be used in developing the conceptual framework of the following chapters, on the basis of a comparison of the review's findings to observations on good priority setting practice in the literature.

1) Involving relevant stakeholders in priority setting process is recommended.

2) Identifying a comprehensive set of criteria through focus group discussions with relevant stakeholders is probably a better approach to obtain a suitable set of criteria.

3) Quantitative techniques such as DCE may be relevant to situations where general guidance on priority setting is required and that qualitative techniques may be more apt in situations where more specific decisions are required on, e.g. implementation of certain interventions (cf. Murray et al. 2000 [9] on the need for generalized vs. highly contextualized cost-effectiveness analysis).

4) Priority setting study should present its final results in a rank-ordering of interventions or, more specifically, identifying interventions that should be included or excluded from, e.g. health benefit package.

In Thailand, cost-effectiveness analysis and burden of disease are often studied in isolation to promote rational priority setting in health care. As an example, Chapter 3 estimated the burden of Shigellosis on the basis of the economic impact of the disease. The cost estimates were based from 137 episodes of 130 patients, and the average public treatment cost was US$8.65 per episode based on 2006 prices. Although of interest on itself, this information provided insufficient guidance to policy makers for making a coverage decision. It concentrated on a single technical solution only (i.e. burden of disease – in this case) whereas in reality, policy makers need to make choices on interventions taking other criteria (e.g. effectiveness, equity, or affordability) into account simultaneously [5, 6, 10-13].

What is the implementation process of MCDA in Thailand?

MCDA was used as an overall framework in the two case studies: to set priorities in HIV/AIDS control; and to define the health benefit package in the Universal Coverage (UC) scheme in Thailand.

a) How to define priority setting criteria?

Chapter 4 identified criteria for priority setting of HIV/AIDS interventions in Thailand using the perspective of policy makers, people living with HIV/AIDS (PLWHA), and community member represented by village health volunteers (VHVs). It revealed that different stakeholders had different preferences vis-à-vis those criteria. We argue that inclusion of different perspectives is important, to enhance the accountability of the priority setting decisions. The case study of HIV/AIDS in this chapter was a first step to integrate different views by documenting differences and similarities.

The DCE in this case study only included the criteria that were found to overlap from the focus group discussions. The rationale for doing so was to accommodate comparability of study findings (so to include identical criteria in DCE for the various stakeholders) on the one hand, while maintaining the number of criteria to a manageable number (thus not including all possible criteria that were put forward by any discussion group) on the other hand. However, this choice may have led to the omission of important criteria for some groups of stakeholders, and may have reduced the validity of study findings. To strike a balance between comparability and validity, a group discussion among relevant multi-stakeholders on the basis of literature review and careful elaboration seems a more appropriate method to ensure that all relevant criteria are identified for the Thai context, as demonstrated in Chapter 6 and 7.

b) How to rank order interventions?

Chapter 5 experimented with the use of MCDA to guide priority setting of HIV/AIDS interventions in Thailand, on the basis of consultations

with the relevant stakeholders, through a deliberative process. We initially rank-ordered 40 HIV/AIDS interventions on the basis of their probabilities of inclusion calculated from the DCE results in Chapter 4. However, since the DCE design only involved a set of criteria amendable to quantification, it ignored a range of non-quantifiable considerations – e.g. ethical, political, and social concerns. As such, any rank ordering of interventions could be indicative only, and should never be interpreted in a mathematical manner. A deliberative process was able to include the non-quantitative criteria and has likely encouraged participatory approaches with a variety of stakeholders and interests. Yet, chapter 5 also highlighted that the provision of the DCE ranking reduced the stream of information that stakeholders needed to absorb in prioritising many interventions simultaneously. As also shown in this chapter, a broad clustering or typology of interventions as 'priorities', 'not priorities', and 'in-between' was a good way to present results to policy makers. Such a broad typology was then a starting point for a more detailed priority setting process, in which policy makers could still deviate from the broad recommendations.

Although we did not engage all stakeholders in a single deliberative process in this case study to arrive at a consensus on the rank ordering of interventions – which would be the final stage of a successful priority setting process – the findings in this study could be a reflection of other stakeholders' preferences for policy decisions that may lead to greater acceptance of priority setting decisions.

Chapter 6 described the first-year experience in applying MCDA as an overall methodological approach to develop the UC health benefit package in Thailand. MCDA was used in the various steps throughout the case study to identify priority setting criteria (for the selection and assessment of interventions), to construct performance matrixes, and to elaborate on these before coming to final conclusions on the coverage of health interventions in the UC scheme.

Although it was difficult to judge in the absence of quantified standards,

MCDA seemed to have considerably contributed to fairness in priority setting as defined in the A4R framework [14, 15]. This framework specified conditions for fair decision-making: reasonableness, publicity, revisable, and enforcement. The merits of MCDA were especially clear when the priority setting process of this case study was compared to the situation before where priority setting was said to be ad-hoc and driven by interests of stakeholder groups.

Again, it was evident that deliberation was an important component of MCDA. Whereas the performance matrix quantifies the performance of interventions on selected criteria, the consideration of other criteria (that cannot be quantified or were for other reasons missing in the performance matrix) is vital in MCDA and is captured in the process of deliberation.

In Chapter 7, we evaluated EVIDEM (Evidence and Value: Impact on DEcision-Making) [16], a tool employing MCDA as its conceptual framework, in its ability to set priorities across a range of interventions. We expressed doubts on the consistency of its results when EVIDEM compares a large set of interventions, for two main reasons. Firstly, the EVIDEM framework ignores the contextual nature of priority setting process by assuming a set of universal priority setting criteria. Secondly, the EVIDEM is vulnerable to interventions ranking inconsistency when different (sets of) interventions are evaluated over time.

c) What are the challenges in the implementation process of MCDA?

This thesis has identified a number of challenges in using MCDA for priority setting of health interventions:

1) Challenges related to the methodology used for identifying criteria and measuring the weight of each criterion. This thesis employed DCE to identify and measure the relative importance of various criteria for priority setting of health interventions among various stakeholders. We observed a number of shortcomings in the use of DCE in the thesis.

- The design of DCE only allows inclusion of a set of criteria amendable to quantification, and a resulting rank ordering of interventions presented in the performance matrix is then only based on those. Yet, it is obvious that any priority setting process should also account for non-quantifiable criteria such as ethical judgments [12], and these cannot be captured through the sole use of DCE.

- DCE is cognitive demanding [17-19] and may not be appropriate for all stakeholders - most notably in Chapter 4 and 5, people living with HIV/AIDS had difficulties in completing DCE survey and interpreting the DCE findings.

- The findings of Chapter 5 showed the homogeneity of the intervention set in terms of the criteria covered in the DCE, and this resulted in low variation in probabilities of inclusion. The application of DCE on interventions targeting the same health condition is in that respect less powerful.

2) Challenges related to the information used for constructing the interventions' performance matrixes as a component of MCDA

- The scoring scales of some criteria were difficult to define, such as, in Chapter 6, targeting the poor and those with rare diseases. The definition and measurement of both criteria was challenging; therefore, in this thesis, these were determined on the basis of experts' opinion and international guidelines (i.e., World Health Report 2002 [20]). Although these two information sources are somehow acceptable, country-specific and more reliable evidence for creating the criteria and the scoring scales' definition should be developed.

- A lack of comparable evidence of each intervention on the severity of disease criterion was found in Chapter 6. While severity of disease has been widely used in priority setting to balance between equity and efficiency concerns in many settings [21-23];

this limitation has led to doubts in using this criterion in MCDA. Hence, this flags serious attention for its further measurement.

3) Challenges related to decision-context

- Some criteria used in MCDA, like cost-effectiveness, are difficult to understand for non-academic people – this constituted a barrier to achieving consensus in group discussions as the general population may be dominated by higher educated people.

- Decision making is a complex process, and resource allocation is inherently political. Although a comprehensive set of criteria have been elicited in priority setting process, policy makers at national level still required room to elaborate their own reasons in the final step to keep their power and authority in decision making. As shown in Chapter 6, the reasons underlying the final decisions regarding the adoption of interventions in the package were not explicitly acknowledged.

How is MCDA best used for priority setting in Thailand?

Chapter 8 capitalized on a first set of experiences on the application of MCDA in LMIC (i.e., Ghana, China, Brazil, Cuba, and Thailand). It reasoned that MCDA seems useful for policy planning in the long run, to set priorities among a large set of interventions. It thereby indicates general perceptions on priorities without defining the allocation of resources in a precise fashion. This use, also labelled *generalized priority setting*, could have far-reaching and constructive influences on policy formulation in the long term. In addition, there is the other type of priority setting that can be undertaken to inform policy makers in a specific context on e.g. the reimbursement of a single intervention, or to prioritise between only a few interventions, either at the national, sub-national or institutional level in a country. This is labelled *context-specific priority setting*.

Lesson learned from the two case studies in the thesis provides ample evidence that MCDA was useful in Thailand in these two broad applications; i.e., to provide broad classifications of interventions within a specific disease area (Chapter 4 and 5), and across a broad set of interventions to guide

decisions at the national-level (Chapter 5 and 6), plus to guide highly contextualized decisions on the implementation of a number of interventions for the health benefit package (Chapter 6).

The findings in chapters 2 – 8 address a number of issues of practical guidance and areas of further research to improve the use of MCDA for priority setting in Thailand. The challenge for priority setting is that there is no gold standard to judge the adequacy of prioritisation decisions made as interest views and therefore priorities of stakeholders may diverge. This is acknowledged by the 'Accountability for Reasonableness' (A4R) framework which is based on the belief that any consensus on priority setting weights and subsequent results may be difficult to achieve because of these distinct perspectives of stakeholders. Instead the A4R framework proposes to concentrate on a fair priority setting process. On this basis, when conditions of reasonableness, publicity, appeal and enforcement are satisfied, it would lead to decisions that are considered fair and acceptable to all stakeholders (as discussed in Chapter 6). The thesis proposes a stepwise process of priority setting on the basis of the first experience on applying MCDA in priority setting in Thailand (Figure 1), that include the fair notions. Details on (some of) the steps are shown below.

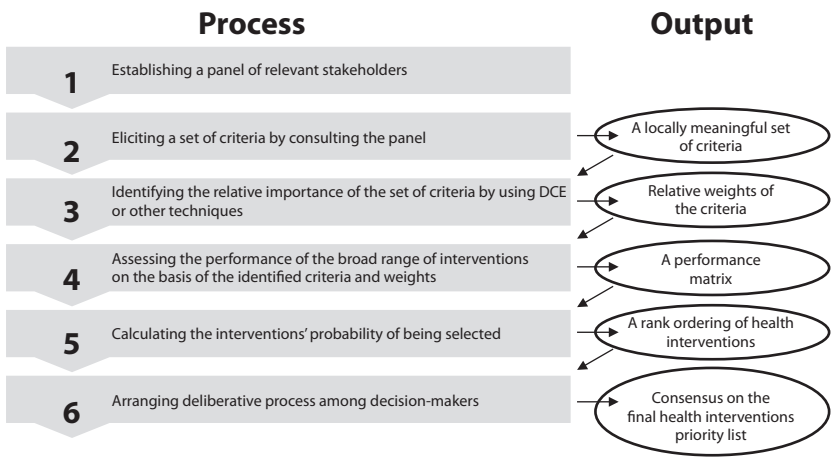


Figure 1 A stepwise process of priority setting of a range of interventions

• *Multiple stakeholders involvement*
Strengthening rational priority setting in health care, not only requires an explicit set of criteria, but also the involvement of all relevant multiple stakeholders in the process of priority setting. Observations of priority setting process in the case studies revealed that the inclusion of all relevant stakeholders right from the beginning of the MCDA process is imperative to its success. This is to include all relevant perspectives to improve legitimacy of final decisions, but also a way to educate other stakeholders who never had experience on making health policy decisions especially the general population to understand how to set priorities for health interventions. However, the problem of diverse stakeholders' views exists. Therefore, exploring how stakeholders' perspectives diverge on identifying criteria, and how these can be consolidated in a consensus on the rank ordering of interventions, is an object for future priority setting research.

• *Scoring system and relative weights of criteria*
To assess the performance of the competing interventions in the performance matrix, it is important to have adequate estimate of the relative weights of criteria and to assess how interventions score on the criteria. This thesis employed two ways to score interventions: i) a dichotomous scale (i.e., scoring '0' or '1' to denote the absence or presence of a criterion level, as presented in Chapter 5); and ii) an ordinal scale (e.g., from 1 to 5 to indicate the scoring level of each intervention on each criterion, as shown in Chapter 6) and it is not clear which one is most suitable. Lessons learned from Chapter 5 and 6 suggest that establishing an explicit definition of the criteria and its measurement are important steps in assessing the interventions' performance.

On the weights of criteria, the findings from Chapter 4 and 5 illustrate the feasibility of using DCE in determining the relative weights of criteria for priority setting. From this first experience of using DCE in this manner, it is clear that experimental design plays a vital role in the performance of a DCE. Therefore, determining an optimal

design for this cognitive demanding technique should be considered in further research. Besides DCE, there are a number of methods that can be used to weigh the criteria. Probably, further research is also needed on the use of less cognitive demanding techniques than DCE that serve the same goal.

• *Comparable local evidence*
The thesis illustrated a lack of comparable evidence of interventions on criteria, and in particular severity of disease in Chapter 6 because of the variation in methods used to estimate severity of disease. This led to doubt in using severity of disease as a criterion in the case study. Lesson learned from Chapter 5 and 6 suggest that although a set of criteria is identified and their relative importance are elicited, the reliability of MCDA results cannot be guarantee if there is no comparable local evidence for supporting the assessment of the interventions' performance. Therefore, country-specific and more reliable evidence should be developed in a uniform methodology.

• *A combination of MCDA and deliberative process*
Whereas the provision of MCDA reduces the stream of dissimilar information by assessing the interventions' performance on a set of criteria in the performance matrix, the consideration of other non-quantifiable (or otherwise absent) criteria that did not present in the performance matrix for any reason is captured in the process of deliberation. Decisions on health intervention priorities should be made by using MCDA, on the basis of consultations with the relevant multiple stakeholders through a deliberative process. Therefore, a combination of quantitative and qualitative approaches is recommended.

The studies presented in this thesis has applied MCDA in the Thai context and its findings may be not generalized to other health care settings. However, MCDA – as a general approach – and all recommendations above are applicable or adaptable to other settings.

References

1. Fleck LM. Just caring: Oregon, health care rationing and informed democratic deliberation. Journal of Medicine and Philosophy. 1994; 19(4):367-88.
2. Ham C, Coulter A. Explicit and implicit rationing: taking responsibility and avoiding blame for health care choices. Journal of Health Services Research and Policy. 2001;6(3):163-9.
3. Martin DK, Walton N, Singer PA. Priority setting in surgery: improve the process and share the learning. World Journal of Surgery. 2003;27(8): 962-6.
4. Vuorenkoski L, Toiviainen H, Hemminki E. Decision-making in priority setting for medicines - a review of empirical studies. Health Policy. 2008;86(1):1-9.
5. Musgrove P. Public spending on health care: how are different criteria related? Health Policy. 1999;47:207-23.
6. Baltussen R, Niessen LW. Priority setting of health interventions: the need for multi-critieria decision analysis. Cost Effectiveness and Resource Allocation. 2006;4:14.
7. González-Pier E, Gutiérez-Delgado C, Stevens G, Barraza-Lloréns M, Porras-Condey R, Carvalho N, et al. Priority setting for health interventions in Mexico's system of social protection in health. Lancet. 2006;368:1608-18.
8. Green C, Gerard K. Exploring the social value of health-care interventions: A stated preference discrete choice experiment. Health Economics. 2008;in press.
9. Murray CJ, Evans DB, Acharya A, Baltussen R. Development of WHO guidelines on generalized cost-effectiveness analysis. Health Economics. 2000;9:235-51.
10. Kapiriri L, Norheim OF. Criteria for priority-setting in health care in Uganda: exploration of stakeholders' values. Bulletin of the World Health Organization. 2004;82(3):172-8.
11. Musgrove P, Fox-Rushby J. Cost-effectiveness analysis for priority setting. In: Jamison D, Breman J, Measham A, Alleyne G, Claeson M, Evans D, et al., editors. Disease Control Priorities in Developing Countries. 2nd

ed. New York: Oxford University Press; 2006.
12. Brock D, Wikler D. Ethical issues in resource allocation, research, and new products development. In: Jamison D, Breman J, Measham A, Alleyne G, Claeson M, Evans D, et al., editors. Disease Control Priorities in Developing Countries. 2nd ed. New York: Oxford University Press; 2006.
13. Teerawattananon Y, Russell S. The greatest happiness of the greatest number? Policy actors' perspectives on the limits of economic evaluation as a tool for informing health care coverage decisions in Thailand. BMC Health Service Research. 2008;8.
14. Daniel N, Sabin J. Accountability for reasonableness. In: Daniel N, Sabin J, editors. Setting limits fairly: Can we learn to share medical resources? New York: Oxford University Press; 2002. p. 43-66.
15. Daniel N. Just health: Meeting health needs fairly. New York: Cambridge University Press; 2008.
16. The EVIDEM Collaboration Executive Office. Evidence and Value: Impact on DEcision Making. Quebec [19 October 2011]; Available from: http://www.evidem.org.
17. Kjær T. A review of the discrete choice experiment – with emphasis on its application in health care. [Health Economics Papers]. In press 2005.
18. Ryan M, Farrar S. Using conjoint analysis to elicit preferences for health care. BMJ. 2007;2000(320):1530-3.
19. Bryan S, Dolan P. Discrete choice experiments in health economics. European Journal of Health Economics. 2004;5:199-202.
20. World Health Organization. The world health report 2002: Reducing risks, promoting health life. Geneva: World Health Organization2002.
21. Jehu-Appiah C, Baltussen R, Acquah C, Aikins M, d'Almeida SA, Bosu WK, et al. Balancing equity and efficiency in health priorities in Ghana: the use of multicriteria decision analysis. Value in Health. 2009;11:1081-7.
22. Stolk E, Poley M. Criteria for determining a basic health services package: Recent developments in the Netherlands. European Journal of Health Economics. 2005;50:2-7.
23. Dolan P, Shaw R. A note on the relative importance that people attach to different factors when setting priorities in health care. Health Expectation. 2002;6:53-9.

Summary

Priority setting of health interventions is one of the most challenging and difficult issues faced by health policy decision makers around the world. It is especially relevant and important in low- and middle-income countries (LMIC), where health needs are large and resources are limited. Thailand, as one of LMIC, has acknowledged this challenge and called for more rational priority setting of health interventions to improve population health in the country.

Chapter 1 introduces the need for rational approaches in priority setting, taking into account a comprehensive set of relevant criteria simultaneously. The main research question of this thesis is "what is an optimal strategy to prioritise health interventions in Thailand?". To answer this question, three research sub-questions are defined and these are responded to in the different chapters.

1. What is the current situation of priority setting of health interventions in LMIC?

The systematic review of empirical priority setting studies in LMIC (Chapter 2) evaluated the current situation of priority setting of health interventions in LMIC. This review revealed an increasing number of empirical studies on priority setting in LMIC in the past decade. Yet, most of them were small pilot studies and did not include an evaluation of the impact of its findings on actual priority setting. Most studies identified sets of relevant criteria for priority setting and involved different stakeholders as respondents. Studies used qualitative or quantitative techniques, or combinations of these to elicit preferences from respondents. In a few studies, respondents deliberated on results. A minority of studies resulted in a rank ordering of interventions. This review illustrated that methods for explicit priority setting are in development, and can potentially lead to solutions for ad hoc priority setting in health care in many LMIC.

In Thailand, cost-efffectiveness analysis and burden of disease are often studied in isolation to promote rational priority setting in health care. Chapter 3 presented a study that reported on a single criterion for priority setting, i.e. economic impact of a disease (i.e., Shigellosis). Although of interest on itself, this provides insufficient information to guide policy makers for making a coverage decision. In reality, policy makers need to make choices on interventions taking a number of criteria (e.g. effectiveness, equity, or affordability) into account simultaneously. This has led to an interest of using multi-criteria decision analysis (MCDA) in health priority setting in Thailand.

2. What is the implementation process of MCDA in Thailand? More specifically: a) how to define priority setting criteria?; b) how to rank order health interventions?; and c) what are the challenges in the implementation process of MCDA?

MCDA was used as an overall framework in the two case studies: to set priorities in HIV/AIDS control (Chapter 4 and 5); and to define the health benefit package in the universal coverage (UC) scheme in Thailand (Chapter 6).

Chapter 4 identified criteria for priority setting of HIV/AIDS interventions in Thailand using the perspective of policy makers, people living with HIV/AIDS (PLWHA), and community members represented by village health volunteers (VHVs). On the basis of these, discrete choice experiments (DCE) were designed to determine the relative importance of criteria for priority setting among 28 policy makers, 74 PLWHA, and 50 VHVs. The results of DCE revealed that different stakeholders have different preferences vis-à-vis these criteria (i.e., target group of intervention, gender of target group of intervention, type of intervention, effectiveness, quality of evidence on effectiveness). The findings of Chapter 4 were used to prioritise 40 HIV/AIDS interventions in Chapter 5. The chapter has documented the feasibility of MCDA to prioritise HIV/AIDS interventions in Thailand by incorporating an explicit component of deliberation to let stakeholders reflect on the

rank ordering, and adapt where necessary. This also shows the usefulness of elaborative process as an integrated component of MCDA.

Chapter 6 described the first experience in applying MCDA as an overall methodological approach to develop the UC health benefit package in Thailand, in the period 2009 – 2010. MCDA was used in the various steps throughout the case study to identify priority setting criteria (for the selection and assessment of interventions), to construct performance matrixes, and to elaborate on these before coming to final conclusions on the coverage of health interventions in the UC scheme. We evaluated the project against the accountability for reasonableness (A4R) framework, and found that MCDA has considerably contributed to rational, transparent and fair priority setting.

In Chapter 7, we evaluated EVIDEM (Evidence and Value: Impact on Decision-Making), a tool employing MCDA as its conceptual framework, in its ability to set priorities across a range of interventions. Then we proposed a stepwise process on the basis of the first experience on priority setting case studies in Thailand.

The thesis has identified three major types of challenges in using MCDA for priority setting of health interventions: 1) challenges related to the methodology used for identifying criteria and measuring the weight of each criterion (i.e., DCE in this thesis); 2) challenges related to the information used for constructing the interventions' performance matrixes as a component of MCDA; and 3) challenges related to the decision-context.

3. How is MCDA best used for priority setting in Thailand?

From the first set of experiences on the application of MCDA in LMIC, MCDA seems useful for two purposes: generalized and context-specific priority setting (Chapter 8). Lesson learned from the two case studies in the thesis provides ample evidence that MCDA is indeed useful to provide broad classifications of interventions within a specific disease area (Chapter 4 and 5), and across a broad set of interventions to guide

decisions at the national-level (Chapter 5 and 6), plus to guide highly contextualized decisions on the implementation of a number of interventions for health benefit package (Chapter 6). The findings of this thesis have shown that MCDA has good potential to be used for explicit priority setting decisions that contributes to the transparency of the priority setting process.

In the General discussion (Chapter 9), the main findings are discussed. It then provides a number of practical recommendations and areas of further research to enhance the potential use of MCDA in Thailand. Since there is no gold standard to judge the adequacy of prioritise decisions, we refer to the A4R framework that focuses on a fair process instead. In addition, we propose a stepwise process of priority setting on the basis of the first experience on applying MCDA in priority setting in Thailand. This includes: i) establishing a panel of relevant stakeholders; ii) eliciting a locally meaningful set of criteria by consulting the panel; iii) identifying the relative importance of the set of criteria by using DCE or other techniques; iv) assessing the performance of the broad range of interventions on the basis of the identified set of criteria and weights; v) calculating the interventions' probability of being selected to rank ordering the interventions; and vi) arranging deliberative process among decision makers (multi-stakeholder based) to reach consensus on the final health interventions priority list.

The studies presented in this thesis has applied MCDA in the Thai context and its findings may be not generalized to other health care settings. However, MCDA – as a general approach – and all recommendations provided in the thesis are applicable or adaptable to other settings.

Samenvatting

Wereldwijd is het prioriteren van gezondheidsinterventies een van de moeilijkste en meest uitdagende kwesties voor beleidsmakers in de gezondheidszorg. Dit is vooral relevant in landen met een laag- en middel inkomen (LMIC), waar de vraag naar gezondheidszorg groot is maar de middelen beperkt zijn. Een van die landen, Thailand, is deze uitdaging aangegaan en heeft opgeroepen tot een rationelere manier voor het prioriteren van gezondheidsinterventies om zo de volksgezondheid te bevorderen.

In Hoofdstuk 1 komt de behoefte aan een rationele aanpak voor het stellen van prioriteiten ter sprake, waarin tegelijk rekening wordt gehouden met een uitgebreid pakket relevante criteria. De belangrijkste onderzoeksvraag van dit proefschrift is "wat is een optimale strategie voor het prioriteren van gezondheidsinterventies in Thailand?". Om deze vraag te kunnen beantwoorden zijn drie deelvragen ontwikkeld die in de verschillende hoofdstukken worden beantwoord.

1. Wat is de huidige situatie wat betreft het prioriteren van gezondheidsinterventies in LMIC?

Het systematische review over prioriteringsstudies in LMIC (Hoofdstuk 2) heeft de huidige situatie wat betreft het prioriteren van gezondheidsinterventies in LMIC in kaart gebracht. Deze studie liet een toename zien in het aantal empirische studies over het stellen van prioriteiten in LMIC in de laatste tien jaar. Echter, het merendeel betrof kleinschalige pilotstudies die een evaluatie van de invloed van de bevindingen op de werkelijke prioritering niet hebben meegenomen. De meeste studies stelden relevante criteria voor het prioriteren vast en betrokken verschillende belanghebbenden als deelnemers. Studies maakten gebruik van zowel kwalitatieve als kwantitatieve technieken of combinaties hiervan om voorkeuren van deelnemers uit te lokken. In een aantal studies hebben de respondenten overlegd over de resultaten. Een minderheid van de studies resulteerde in een rangorde van interventies.

Dit review laat zien dat methoden voor het expliciet stellen van prioriteiten in ontwikkeling zijn, en dat deze mogelijk kunnen leiden tot oplossingen voor het ad hoc stellen van prioriteiten in de gezondheidszorg in vele LMIC.

In Thailand worden kosteneffectiviteitsanalyses en ziektelast vaak afzonderlijk bestudeerd om het stellen van rationele prioriteiten in de gezondheidszorg te bevorderen. Hoofdstuk 3 presenteert een studie die één enkel criterium voor het prioriteren rapporteerde, namelijk de economische impact van een ziekte (Shigellose). Hoewel dit op zich van belang is, levert dit onvoldoende informatie op om voor beleidsmakers als leidraad te dienen bij het maken van verzekeringsdekkingsbeslissingen. In werkelijkheid moeten beleidsmakers interventies kiezen door gelijktijdig rekening te houden met verschillende criteria (zoals bijvoorbeeld effectiviteit, rechtvaardigheid of betaalbaarheid). In Thailand heeft dit geleid tot belangstelling voor het gebruik van multi-criteria decision analysis (MCDA) voor het stellen van prioriteiten binnen de gezondheidzorg.

2. Hoe wordt MCDA in Thailand ingevoerd? Specifiek:
   a) hoe worden prioriteringscriteria geformuleerd?;
   b) Hoe zouden gezondheidsinterventies in een rangorde moeten worden geplaatst?; en
   c) wat zijn de uitdagingen binnen het invoeringsproces van MCDA?

MCDA werd gebruikt als overkoepelend model in twee casestudies: om prioriteiten te stellen in het bedwingen van HIV/AIDS (Hoofdstuk 4 en 5); en om het basispakket te definiëren in de universele basisdekking in Thailand (Hoofdstuk 6).

Hoofdstuk 4 identificeert criteria voor het prioriteren van HIV/AIDS interventies in Thailand, vanuit het perspectief van de beleidsmakers, mensen die leven met HIV/AIDS en leden van een gemeenschap die worden vertegenwoordigd door gezondheidsvrijwilligers uit dorpen. Op basis hiervan werden discrete choice expiriments (DCE) ontworpen om

het belang van de verschillende criteria voor het stellen van prioriteiten onder de 28 beleidsmakers, 74 mensen die leven met HIV/AIDS en 50 gezondheidsvrijwilligers te bepalen. Het resultaat hiervan liet zien dat de belanghebbenden verschillende voorkeuren hebben voor deze criteria (d.w.z. de doelgroep van de interventies, geslacht van de doelgroep, het type interventie, de effectiviteit en de kwaliteit van de bewijs van de effectiviteit). De bevindingen van Hoofdstuk 4 zijn gebruikt om 40 HIV/AIDS interventies in Hoofdstuk 5 te prioriteren. Dit hoofdstuk heeft de haalbaarheid van MCDA voor het prioriteren van HIV/AIDS interventies in Thailand beschreven door expliciet een overleg te integreren, om zo belanghebbende over de rangorde te laten nadenken en deze waar nodig aan te passen. Dit laat ook het nut van overleg als een geïntegreerd onderdeel van MCDA zien.

Hoofdstuk 6 beschrijft de eerste ervaring met het toepassen van MCDA als een algemene methodologische aanpak voor het ontwikkelen van een universeel basispakket in Thailand, in het periode 2009-2010. MCDA werd gebruikt in de verschillende stappen binnen de casestudie om prioriteringscriteria te identificeren (voor het selecteren en beoordelen van interventies), om een performance matrix te construeren en uit te werken, alvorens tot een eind conclusie te komen wat betreft dekking van gezondheidsinterventies in het universele basispakket. Met behulp van het accountability for reasonableness (A4R) model hebben we het project geëvalueerd en gevonden dat MCDA aanzienlijk heeft bijgedragen aan een rationele, transparante en eerlijke prioritering.

In Hoofdstuk 7 hebben we EVIDEM (Evidence and Value: Impact on Decision -Making) geëvalueerd, een instrument dat MCDA gebruikt als het conceptuele model met zijn vermogen om prioriteiten te stellen binnen een reeks interventies. Vervolgens stelden we een stapsgewijs proces voor op basis van de eerste ervaringen met prioriteren in de casestudies in Thailand.

Dit proefschrift heeft 3 belangrijke vraagstukken vastgesteld in het gebruik van MCDA voor het prioriteren van gezondheidsinterventies:

1) vraagstukken gerelateerd aan de methodologie die gebruikt wordt voor het identificeren van criteria en het meten van het belang van elk criteria (d.w.z. DCE in dit proefschrift); 2) vraagstukken gerelateerd aan de informatie die wordt gebruikt voor het construeren van de prestatie matrices van de interventies als een component van MCDA; en 3) vraagstukken gerelateerd aan de besluitvorming.

3. Hoe kan MCDA het best worden gebruikt voor het stellen van prioriteiten in Thailand?

Uit de eerste ervaringen met het toepassen van MCDA in LMIC lijkt MCDA nuttig voor twee doelen: generaliserend en context-specifiek prioriteren van interventies (Hoofdstuk 8). De twee casestudies in het proefschrift leveren ruim bewijs dat MCDA daadwerkelijk nuttig is om generaliserende, grove indelingen van interventies op een specifiek ziektegebied te maken (Hoofdstuk 4 en 5), om als leidraad te dienen voor besluitvormingen over een ruim pakket interventies op nationaal niveau (Hoofdstuk 5 en 6), en om als leidraad te dienen voor zeer contextgebonden beslissingen over het opnemen van een aantal interventies in het basispakket (Hoofdstuk 6). De bevindingen van dit proefschrift hebben laten zien dat MCDA veel potentie heeft om te worden gebruikt voor expliciete prioriteringsbesluiten die bijdragen aan de transparantie van het prioriteringsproces.

In de Algemene Discussie (Hoofdstuk 9) worden de belangrijkste bevinden besproken. Vervolgens biedt het hoofdstuk een aantal praktische aanbevelingen en domeinen voor verder onderzoek om de kans op het gebruik van MCDA in Thailand te vergroten. Aangezien er geen gouden standaard is om de geschiktheid van prioriteringsbesluiten te beoordelen, verwijzen we naar het A4R model dat zich concentreert op eerlijke processen. Bovendien stellen we op basis van de eerste ervaringen met het toepassen van MCDA in het stellen van prioriteiten in Thailand een stapsgewijs prioriteringsproces voor. Dit bevat: i) het samenstellen van een comité met relevante belanghebbenden; ii) het verkrijgen van een pakket met lokaal belangrijke criteria door het comité te raadplegen; iii) het vaststellen

van het relatieve belang van de criteri, dat wil zeggen gewichten, door gebruik te maken van DCE en andere technieken; iv) het beoordelen van de doelmatigheid van de interventies op basis van de criteria en de gewichten; v) het berekenen van de kans dat de interventie wordt geselecteerd om in de rangorde te worden opgenomen; vi) het organiseren van een overleg tussen beleidsmakers (op basis van meerdere belanghebbenden) om consensus te bereiken over de uiteindelijk prioriteringslijst voor gezondheidsinterventies.

De onderzoeken die in dit proefschrift worden gepresenteerd hebben MCDA toegepast in een Thaise context en de bevindingen hiervan kunnen mogelijk niet worden gegeneraliseerd naar andere contexten. Echter, MCDA, als een algemene aanpak, en alle aanbevelingen die in dit proefschrift worden gedaan zijn toepasbaar op of aan te passen aan andere omstandigheden.

List of publications

Original articles related to this thesis

Youngkong S, Teerawattananon Y, Tantivess S, and Baltussen R. Multi-criteria decision analysis for setting priorities on HIV/AIDS interventions in Thailand. Health Research Policy and Systems 2012; 10: 6.

Youngkong S, Tromp N, and Chitama D. The EVIDEM framework and its usefulness for priority setting across a broad range of health interventions. Cost Effectiveness and Resource Allocation 2011; 9: 8

Youngkong S, Baltussen R, Tantivess S, Koolman X, and Teerawattananon Y. Criteria for priority setting of HIV/AIDS interventions in Thailand: A discrete choice experiment. BMC Health Service Research 2010; 10; 197.

Baltussen R, **Youngkong S,** Paolucci F, and Niessen L. Multi-criteria decision analysis to prioritize health interventions: Capitalizing on first experiences. Health Policy 2010; 96: 262-264.

Youngkong S, Kapiriri L, and Baltussen R. Setting priorities for health interventions in developing countries: An review of empirical studies. Tropical Medicine and International Health 2009; 14(8): 930-9.

Riewpaiboon A, **Youngkong S,** Sreshthaputra N, Stewart JF, Samosornsuk S, Chaicumpa W, et.al. A cost function analysis of shigellosis in Thailand. Value in Health 2008; 11(Suppl1): S75 – S83.

Submitted paper

Youngkong S, Baltussen R, Tantivess S, Mohara A, and Teerawattananon Y. Multi-criteria decision analysis for including health interventions in the universal health coverage benefit package in Thailand.

Other publications

Mohara A, **Youngkong S,** Pérez Velasco R, Werayingyong P, Pachanee K, Prakongsai P, Tantivess S, Tangcharoensathien V, Lertiendumrong J, Jongudomsuk P, and Teerawattananon Y. Using health technology assessment for informing coverage decisions in Thailand. Journal of Comparative Effectiveness Research 2012; 1(2): 1-10.

Defechereux T, Paolucci F, Mirelman A, **Youngkong S,** Botten G, Niessen LW, and Hagen TP. Health care priority setting in Norway: A multi-criteria decision analysis. BMC Health Services Research 2012; 12: 39.

Lertpitakpong C, Chaikledkaew U, Thavorncharoensap M, Tantivess S, Praditsitthiknorn N, **Youngkong S,** Yothasamut J, Udomsuk K, Sinthitichai K, and Teerawattananon Y. A determination of topics for health technology assessment in Thailand: making decision makers involved. J Med Assoc Thai 2008; 91(Suppl 2): S100-109.

Youngkong S. Cost–benefit analysis of Japanese Mint planting comparison between soiled planting and hydroponics technique for volatile oil proposes. Thai Pharmaceutical and Health Science Journal 2006; 11(1): 10 – 17.

Youngkong S, Riewpaiboon A, Towanabut S, and Riewpaiboon W. Unit costs of medical services at Prasat Neurological Institute. Srinakharinwirot Journal of Pharmaceutical Sciences 2004; 9(1): 52 – 58.

Youngkong S, Riewpaiboon A, Towanabut S, and Riewpaiboon W. Costs of cerebral infarction in societal perspective. Srinakharinwirot Journal of Pharmaceutical Sciences 2002; 7(1): 95 – 105.

Veraanuntavat P, Phanumaphorn M, Kongkaew C, **Youngkong S,** and Kongsamai P. Work measurement in the outpatient dispensing service at Sena Hospital. Thai Journal of Hospital Pharmacy 2001; 11(1): 7 – 15.

Thepsuparangsikul N, Peerapattanapokin W, Kongkaew C, and **Youngkong S.** Risk identification at outpatient dispensing service. Thai Journal of Hospital Pharmacy 1999; 9(3): 238 – 47.

Acknowledgement

This thesis would not have been successful completed without the contributions from many people and organizations. First of all, I would like to thank the South-East Asia Regional Office of World Health Organization for granting me the fellowship to study this PhD, also to my workplace in Thailand, Health Intervention and Technology Assessment Program (HITAP), for providing me the great opportunity to study in the Netherlands.

I would like to record my gratitude to my promotor, Prof.Dr.Koos van der Velden for accepting me as his PhD student, and for his good advice and guidance since start until successful. He has been a supportive promotor to me throughout my PhD studying and has always given me great freedom to pursue independent work.

I owe my deepest gratitude to my co-promotor, Dr.Rob Baltussen, whose encouragement, supervision and support from the preliminary to the concluding level enabled me to be an outstanding researcher. Thank you very much for helping me dealing with all the problems during tough times in the PhD. I have also benefited by his advice and crucial contribution who always kindly grants me his time even for answering some of my unintelligent questions. He is not only my excellent supervisor, but he is also a very nice colleague. I have learnt to say 'No' to professors with logical and sensible arguments. I am indebted to him more than he knows.

I would like to thank Dr.Yot Teerawattananon, the other co-promotor and the leader of HITAP (my boss), for inspiring me to study in this area that his vision told him that it will become one of the most important and popular areas of health systems research in the future. Above all and the most needed, he provided me unflinching encouragement and support in various ways. His advices and comments on my fieldwork in Thailand and throughout the study were really appreciated.

I am heartily thankful to Dr.Suwit Wibulpolprasert (senior advisor at the Thai Ministry of Public Health, Thailand) and Dr.Viroj Tangcharoensathien (the former director of International Health Policy Program, Thailand), for their confidence in me since the very early stage of my involvement at HITAP. They both always teach me how to be a good researcher and how to make a contribution to the Thai society. Their comments on my PhD work were always challenging me. It is an honor for me to learn from their extraordinary experiences throughout the PhD work and my further research in Thailand.

My sincere appreciation goes to Dr.Sripen Tantivess, a senior researcher at HITAP, who always gave me thoughtful and constructive comments on the manuscripts and thesis. Her supports were really appreciated. Special thank to Dr.Lydia Kapiriri who contributed her thoughtful collaboration to the first publication of my PhD. I really appreciate her kindness and contribution. I would like to thank Dr.Xander Koolman and Mr.Hans Bor who helped me a lot with statistical analysis.

Special thank should also be given to Assoc.Prof.Dr.Arthorn Riewpaiboon, my former supervisor of my master-degree thesis, for his kindness and always support me since I was studying with him. He provided me a great opportunity to involve in an International Vaccine Institutes' project and its study is presented in a chapter of this thesis.

I would like to express my gratitude to other members of Nijmegen International Center for Health Systems Research and Education (NICHE), Radboud University, Dr.Ernst Spann, Dr.Francoise Barten, Dr.Evert Ketting, Dr.Henri van Asten, Mariana Posse, Noor Tromp, Caroline Jehu-Appiah, Genevieve Aryeetey, Dereck Chitama, Adiatma Siregar, Sten Zelle, and Jan Hontelez, for their kind and encouragement during my PhD. We were and will always be a very good team in health systems research, I believe. My gratitude extends to my friends at the office, Nathalie, Judith, Hiske, Wouter, Mai, Jeannine, Joris, and Stephanie, for their friendship and support when I was in the Netherlands. I enjoyed very much international environment, dinners, chit-chat, complaint, movies, ice-

skating, and other activities we have done together in Nijmegen. Without them, my life here would not have been fun and worth to memorise. It was also wonderful to remember that you all like my soup 'Tom-Kha-Kai' even it was the first dish I cooked by myself.

I convey special acknowledgement to Laura Kamp, Roderik Viergever, and Wouter van Suylekom, for their kind offer and help on the 'Samenvatting' of this thesis. Also, I would like to thank the secretariat team of the Department of Primary and Community Health, Dragana, Annemarie, Twanny and Tilly, for their supports and help in many administrative things.

My special thanks go to Dorothé and her husband for their great Indonesian dinners, to Nini Carpentier and her family for their kindness and hospitality during my stay in the Netherlands.

Many thanks to the Thai student association in the Netherlands (TSAN) and my Thai friends; Kukiat, Sasinee, Atthaphon, Siraprapa, Chayada, Chol, Nathawut, Panya, Ranittha, Rattana, Panwasa, Piyanit, Kamala, Sathidpak, Rotchong, Pawadee, Panayu, Chukeat, Chatchote, Pichai, Arnon, Chaweng, Sawaluck and others, who I do not mention here, for their friendships and supports. We had a good time in the Netherlands and this will never be forgotten.

I am sincerely grateful all staffs at HITAP who worked very hard for the country when I was leaving for my PhD studying in the Netherlands.

Special thanks to Noor and Mariana, my paranimfs, for their kindness and helps for arranging my promotion celebration.

My deepest gratitude goes to my warm and lovely family, my beloved parents, two younger brothers, as well as my grandmother who deserve special mention for their unconditional love and supports. Their love and encouragement allowed me to finish this journey. Thank you very much.

Finally, I would like to thank everybody who was a part of the successful

realization of thesis, as well as expressing my apology that I could not mention their names one by one. I really appreciate their support and encouragement during my PhD in the Netherlands. Thank you.

Sitaporn Youngkong

Curriculum Vitae

Sitaporn Youngkong
Home address: 18/161 Sukhumwit Road, Muang, Samutprakan, 10270 Thailand
Email: sitaporn.y@hitap.net
Main research interests: Priority setting in health care, discrete choice experiments, health technology assessment, economic evaluation

WORK

- Researcher (2006 – Present)
  Health Intervention and Technology Assessment Program (HITAP)
  Ministry of Public Health, Thailand
- Lecturer (1998 – 2007)
  Faculty of Pharmacy, Srinakharinwirot University, Thailand

EDUCATION

- PhD researcher in Health Economics (2007 – 2011)
  at Radboud University Nijmegen, The Netherlands
  - The World Health Organization (WHO) fellowship award
- Master of Science in Hospital Pharmacy (1999 – 2001)
  at Mahidol University, Bangkok, Thailand
- Bachelor in Pharmacy at Chiang Mai University (1993 – 1996)
  Chiang Mai, Thailand

MULTI-CRITERIA DECISION ANALYSIS FOR PRIORITY SETTING OF HEALTH INTERVENTIONS IN THAILAND